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Electrical World

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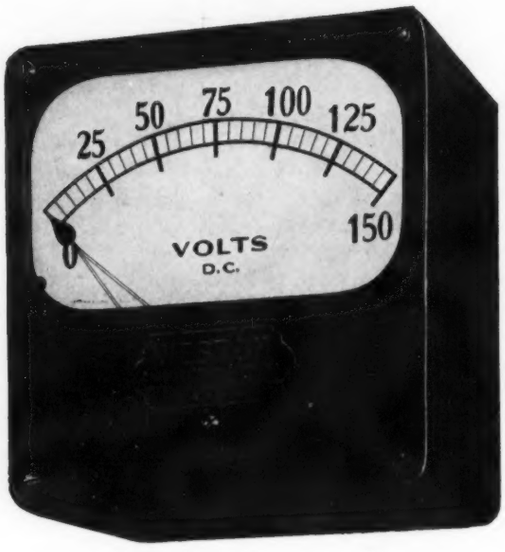

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Refrigeration Survey Balance Sheet

LAST week the ELECTRICAL WORLD published the results of a national electric refrigeration survey. This was part of the normal editorial service to the industry made possible by a large and well-organized staff of editors who respond to industry developments quickly and seize upon opportunities for service.

The reader of a nineteen-page article and a table containing 55,000 items does not realize what the published material represents in terms of travel, editorial time, expenses and thoughtful analysis. The following balance sheet may help give some idea of the practical features of such service:

Time required in the field	**Six weeks**
Time required in office to analyze results and write article	**Three weeks**
Miles traveled in the field	**16,000**
Number of editors in the field	**13**
Number of editors in the office	**3**
Field traveling expenses	**$4,680**
Editorial salaries	**$7,500**
Publishing costs and incidentals	**$1,000**

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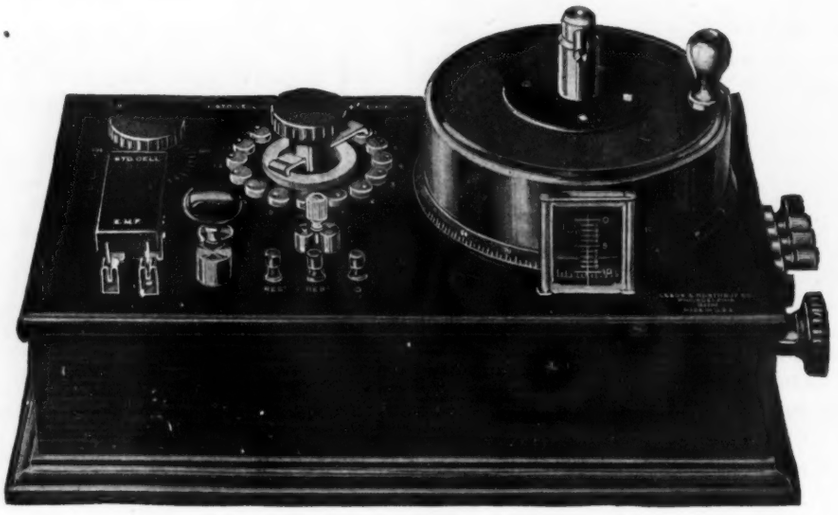

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Electrical World

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W. H. ONKEN, JR.
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Building Systems According to Plans

IS IT possible to predict the future light and power systems? Should any attempt be made to generalize on principles for developing systems in order to meet future conditions? Engineers in the industry would like to have answers to questions of this character, and accurate answers would save the industry millions of dollars and many trials and tribulations in giving service during the coming years. But answers are difficult to formulate in terms of mathematical or economic exactness.

Each light and power company passes through successive stages of development. As local conditions and regional conditions change and as load grows there comes about a service or economic necessity to remodel the system, and these changes occur at different times on the properties. A small system with an overhead installation soon grows to such a degree that an underground installation must be made. At certain times on different properties there may occur a direct-current installation for a heavy load area, an interconnection with a neighboring system or a consolidation as a unit of a large transmission system. Then, again, there may be a necessity to adopt automatic substations, an installation of railway substations and frequency changers or two or more new transmission and distribution voltages. A metropolitan system grows into a network of radial and loop feeders with multiple stations and then interconnects with transmission systems.

Even those properties which have passed through several stages of development find it difficult to state principles or to outline plans which would aid other properties encountering the same problems at a later date. For example, the problem of changing from overhead to underground or from three-phase, three-wire distribution to three-phase, four-wire distribution has been solved by many properties and must be solved by many other properties in the future. Likewise, a transmission system which has extended from town to town eventually consolidates into a major transmission system and subordinate systems, and many have gone through the process. But local conditions are so influential and the future requirements of service are so indeterminate that it is difficult to state principles which have any value for general application at the present time. It would seem possible to approach this aspect of system planning by taking the experiences of many properties and deriving from these data a group of principles and certain definite plans which would help greatly those systems which have yet to pass through these stages of development.

But the system of the future is very difficult to predict, even though an ideal situation be conceived in which existing investments and systems could be disregarded. The industry knows that load densities will grow enormously in certain areas in the next twenty years. It knows that some sort of large transmission and distribution network will have to be constructed in the industrial areas of the East and Middle West. It knows that generating sources will pool their output to supply these networks. However, this is a very vague statement of conditions and helps little in stating the problem. Is it possible or desirable to assume for such a development a 220,000-volt major transmission system, subordinate systems at 132,000, 66,000 and lower voltages and distribution systems at 22,000, 13,200, 6,600 and 4,000 volts? Will it be best to keep all load taps from transmission systems, and will the tie lines between generating stations be free from load taps and interconnections? Will the network principle be best to follow in building up a distribution system?

These and a hundred similar questions must be answered, and the answers involve a detailed study of equipment limitations and possible future developments in equipment. Shall the system of the future be planned on a 100 per cent service basis for all services and thus involve the enormous increase in investment and complexity this necessitates?

All agree that light and power systems must grow according to a plan and that the plan should be based on a long-time perspective. But only a very detailed and intensive study can determine the answer to this big, fundamental problem of the whole light and power industry. It well deserves the attention it is now receiving from the engineers of the industry.

Farm Power an Economic Question

MUCH has been said in recent discussions about the desirability of providing the farmers of this country with electric power. No one will question for a moment the fact that the farmer should have available power as cheap as is possible in order to permit him to take full advantage of the replacement of hand labor by machinery. However, little authentic information has been published on the economics of furnishing farm power. This side of the question deserves intensive study both by the power-station engineer and by the farmer if equitable rates are to be established and if future difficulties shall be avoided.

The farmer would use electric power for pumping of water, cutting and grinding stock feed, milking cows, operating milk separators and other dairy machinery, driving threshing machinery, for household appliances, for cutting wood and for other miscellaneous purposes. These are all intermittent services and are spread over the day so that there would be a fair measure of diversity among various farmers. The farmer's demand would be small and the power factor low. He retires early so that he will contributed almost no night load, and during the summer months he will use virtually no electricity for lighting. Furthermore, his lighting load for barns and home will tend to intensify the 6 o'clock peak of many power systems during the winter season. Thus only a low load factor may

be expected from farm power loads as these now exist—and this conclusion is supported by studies of one large system.

Can this condition be remedied? Here is an economic problem. On the one hand, there is the possibility of further mechanizing the farm—that is, providing additional machinery and devices to replace farm labor. This would seem a desirable thing, but such equipment costs money and agricultural machinery in general has a low annual-use factor. There is considerable doubt whether the farmer can afford to invest in such equipment in view of present prices for farm products. This point of view, in fact, is held by many bankers. Furthermore, radical changes in farm methods would be necessary to get the most out of farm power.

The farmer is a conservative by nature and changes slowly. He will welcome farm power, but can he afford it? The electric utility company seeking added load will stretch out to reach the farm market and will promote every device to increase the use of power. Such extensions are expensive. Can the company afford to take on such power and at what rates? Will the rates actually cover cost of service? These economic questions deserve study by both sides. Facts rather than opinions should be presented to the public on the whole difficult question of electricity for farmers.

Personality Wins in Negotiating Contracts

LIKE all other industries, the electric utility business depends in the last analysis upon personnel for success. The time will never come when it will be safe to rely upon machinery alone to serve the public and to develop that service adequately and economically. By the same token negotiations between companies cannot be satisfactorily carried on in a mechanical way, and the influence of personality upon the making of intercompany and other power contracts is fundamental. In a typical case which lately came to hand the negotiations between a selling and a buying utility were begun by a manager fresh from an outside syndicate. His approach was not acceptable to the second company, and the negotiations soon came to an apparently hopeless deadlock, which was solved only by the withdrawal of the manager from the conference table and the substitution of his sales manager in his place. This second representative was well acquainted with the officials of the buying company from long residence in the territory, and immediately negotiations proceeded toward a satisfactory agreement. The spirit of give and take was invoked, and in a short time a contract was concluded acceptable to both parties and sufficiently elastic to meet the conditions of a transition period in local utility development.

To conclude from this that a new or an outside man is out of place in negotiating local contracts would be absurd, but, as the principal representative of the buying company remarked, the importance of capitalizing the personality of men known to local organizations should not be overlooked by those in charge of newly acquired properties. Plenty of contracts can be concluded by outsiders if the proceedings are carried on in such a way that the local men do not feel that they are being "ridden." Personality tells, whether in the local man or in the outsider; but in the long run years of business friendship add value to personality and are an advantage in delicate negotiations. Something more than mathematical computations enters into contract making, important as are the figures upon which agreements must be based. This is an old truth, but it should not be forgotten by executives and engineers anxious to make progress in extending the usefulness and prosperity of their organizations.

Growing Importance of the Ironing Machine Market

A SMALL group comprising the principal manufacturers of electric ironing machines met together last week to discuss their common market problems, and they organized an association. It is an interesting event because it marks the awakening of a new branch of the electrical appliance industry that seems destined to play a much larger part in the years ahead.

The weekly laundering of clothes is a major function in the household. That is why the electric clothes washer made such a fundamental appeal to the women of the United States. But the clothes washer did not solve the ironing problem. And the electric flatiron, although it brought a gift of comfort and convenience and has won a more complete acceptance than any other electric household appliance, does not change the age-old process of ironing by pressing with a hot iron every surface square inch of the fabric. Women are just as eager to be spared hours of standing on their feet as to be freed from the washtub, and this is just what the domestic ironing machine offers.

There are three other reasons, however, why the ironing machine manufacturers are coming into the center of the appliance picture—the growth of the wet-wash service in this country, the growing recognition by the power companies of their need for residence load and the increased spending margin now enjoyed by the American family. Sixty per cent of the steam laundries of the country now operate wet-wash departments, and this method of solving the household laundry problem has won such popularity that today 350,000 bundles of wet wash are delivered each week in Chicago to a total of 690,348 homes, which is an increase of 100,000 bundles per week over the year before. The home that uses the wet wash probably will not buy a clothes washer, but it is a natural "prospect" for an ironing machine.

Obviously this points an opportunity for the central-station company. Only about 250,000 ironing machines are now in use, yet this appliance will consume 200 kilowatt-hours a year and bring in an annual revenue of $12, which is 40 per cent as much as the present average total income from residences throughout the country. It is worth selling, even though it is an appliance that needs a lot of pioneering because of the degree to which the success of the machine depends upon the proficiency of the operator. The ironing machine must be more carefully demonstrated, the customer must be more thoroughly instructed than in the selling of the clothes washer.

But women want ironing machines. The idea appeals. And today they have the money to buy them. The spending margin between wages, salaries and the cost of living in this country was never so wide. The percentage of savings bank deposits, insurance ownership,

participation in building and loan associations, ownership of homes and possession of personal property has never reached so high a level. The market for household equipment has never been so promising.

Therefore, the organization of an association of electric ironing machine manufacturers is a step forward, for there is much work to be done co-operatively in arousing the market. Incidentally here is another group that ultimately should be gathered into an Appliance Division of the National Electrical Manufacturers' Association to unite the manufacturers of all electrical household appliances for the promotion of their common interests in the complete electrical equipment of the American home.

Arc Phenomena and Theory Challenged

DOWN to voltages of the order of 50, either alternating or continuous, it is not difficult to account for the occurrence of an arc in terms of the magnetic inductance of the circuit. With arcing potential difference present, it is easy to account for the continuance of an arc by the vaporization of the terminals. However, the occurrence of a spark following the interruption of a low-voltage circuit, such as that between the terminals of a dry cell, is not so obvious. There is no possibility of sufficient inductance to cause an arc.

It is obvious that another explanation must be sought, and it is evident that it must be found in some form of temperature elevation. A brief paper by J. Slepian in the October *Journal of the A.I.E.E.* throws some light on the subject. It describes a study of the temperatures reached as the contact between different metals is reduced to the last and most minute point with corresponding increase of current density. These temperatures may exceed those which correspond to thermionic currents from metals and also to thermal ionization current densities in the gas between the terminals.

Therefore it appears that the spark of the low-voltage circuit is commonly due to the evaporation of the final contact caused by the extreme high temperature. Very short life of contacts has resulted even when operated in a vacuum. The well-known limits of voltage between commutator bars are equally well accounted for by the temperature of the last point of contact of brush and segment. A similar agreement is indicated for the contact drop of carbon brushes and the voltage at which the relatively few points of intimate contact reach such high temperatures that the surrounding space becomes conductive.

A new line of experimentation on arcs in vacuo has been completed recently by Prof. R. E. Sorenson which is difficult to reconcile with the theory and experiments of previous investigators. A very high vacuum was used in breaking an arc, and after repeated trials no pitting of contacts or volatilization of electrode terminals occurred. The heavy-current density arcs were extinguished time after time at the first zero point of the wave with simple copper electrodes. Theories of thermionic emission and of gaseous ionization are applied with difficulty to the phenomena encountered.

This recent work on arcs calls for renewed research work and the discarding of preconceived notions of the theory of arc formation and cessation. A promising field is open, the development of which may have considerable commercial application to switching on large power circuits.

Cost of Getting Business Justified by Revenue

TO QUESTION expenditures from the standpoint of definite results gained is good business practice. Recently a New England light and power company under centralized management learned that the cost of seeking new commercial lighting business during the previous month was $475. To the local management this outlay looked like a substantial expenditure, especially when prorated at twelve times this amount for a year's service on the part of the business-building staff of the syndicate. The attention of the headquarters office was called to the matter; the per annum rate was stressed and the justification of the cost queried.

Headquarters records showed that during the month new commercial and industrial lighting business aggregating 53,090 kw.-hr. per year was obtained on the local company's lines out of recommended jobs totaling 96,660 kw.-hr. Eight recommended jobs were secured out of eighteen investigated, and the annual revenue added to the company's earnings on account of the new installations made totaled $3,185. The total revenue which the company would obtain if all the recommended jobs were to go in was put at $5,799. Without allowing for the acquisition of a portion of the recommended business sure to follow the field work of the syndicate plus that of a lighting salesman on the local staff, the yield in gross revenue in one year will be more than six times the cost of getting the load upon the lines, including the cost of local company effort. These definite results were promptly sent to the local utility, thanks to the maintenance of proper records by the headquarters organization, and will be continued monthly as long as needed.

Such incidents are "all in the day's work" of not a few management staffs, but it is doubtful whether either the public or the executives of many independently managed utilities realize the extent to which costs of the foregoing kind are put under fire in holding-company groups. It is too easily assumed that because a given property is run by local executives, closely identified as these may be with the executives of the headquarters organization, costs are allowed to grow unduly large. This assumption sometimes finds its way into rate and capitalization hearings to the detriment of the reputation of the utility men concerned. Therefore it is a sign of first-class stewardship on the part of both headquarters and local managements to subject such costs to analysis and to be able to justify them by "rock-bottom" and "hard-boiled" data of the type illustrated.

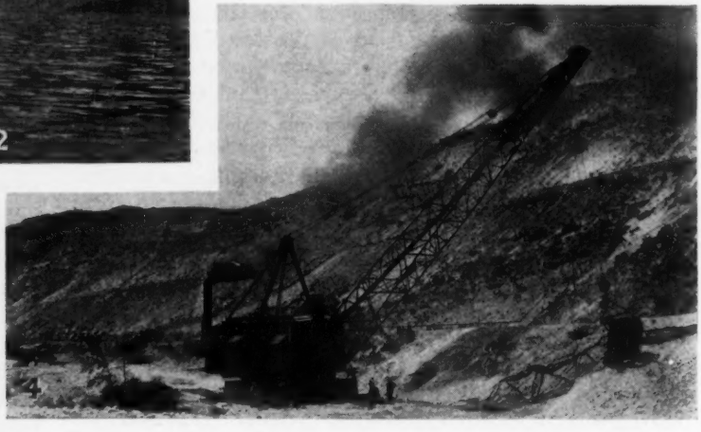
Immediate yields cannot, of course, be credited to every class of load-building outlay, but in the development of commercial lighting the results so often synchronize with the field effort that the value of the latter can be very fairly approximated. This is one more compelling reason for pushing commercial and industrial lighting sales activities to the limit of the local market's purchasing power. The old slogan of "any new business is good business" should be supported by facts in every case, and these facts can be obtained readily.

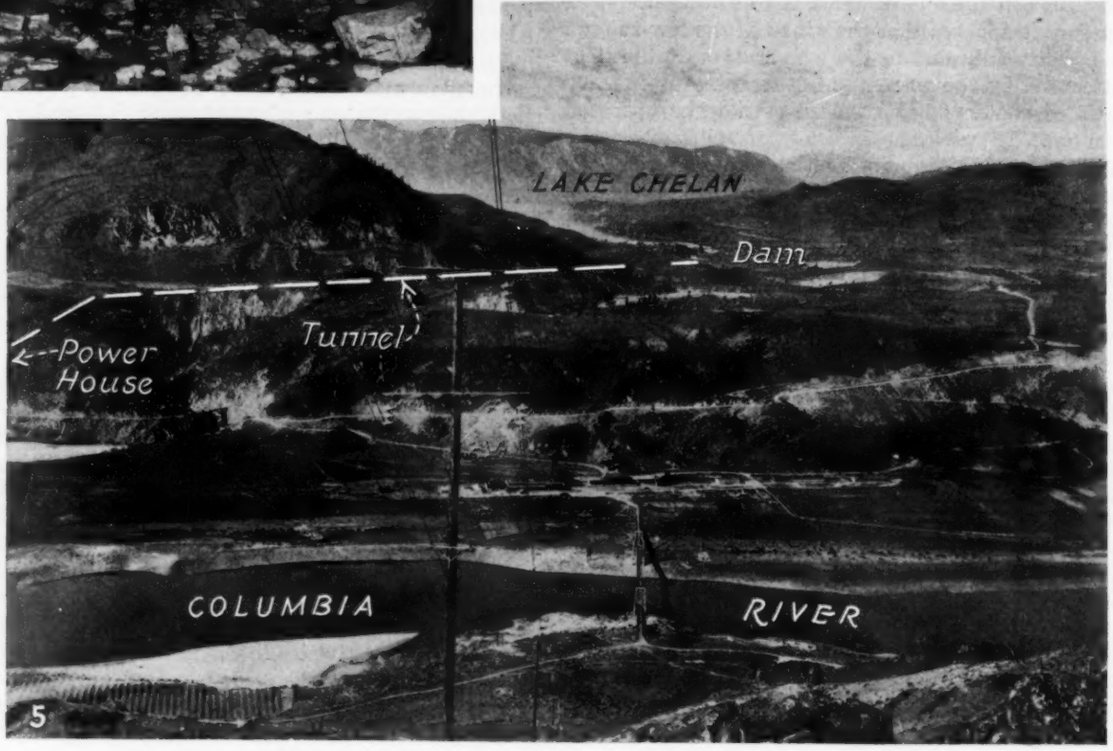
Chelan Project in Washington Making Progress

WITH 600 men on the job at the Chelan project of the Chelan Electric Company in central Washington, about 3,500 ft. of the 12,000-ft. tunnel had been completed ready for concrete on Aug. 15 and excavation work was well under way for the power station and the surge tank.

Power is expected from the first unit at this development in June, 1927, according to M. W. Birkett, vice-president and general manager. The first unit, being installed, will have a generating capacity of 32,000 hp., and the proposed total capacity of the plant when completed will be 128,000 hp.

1. North end of tunnel in gravel formation.
2. Lake Chelan.
3. Halfway through the 12,000-ft. tunnel.
4. Shovel at power-house site.
5. Chelan development.





Newspaper Press Drive and Control

Modern Unit-Type Presses Have Separate Motors for Threading and Running Speeds—Silent-Tooth Chain Drive Popular—Conveniently Located Push-Button Control Stations Afford Flexibility of Operation and Safety

By E. H. LAABS
Engineering Department, Cutler-Hammer Manufacturing Company

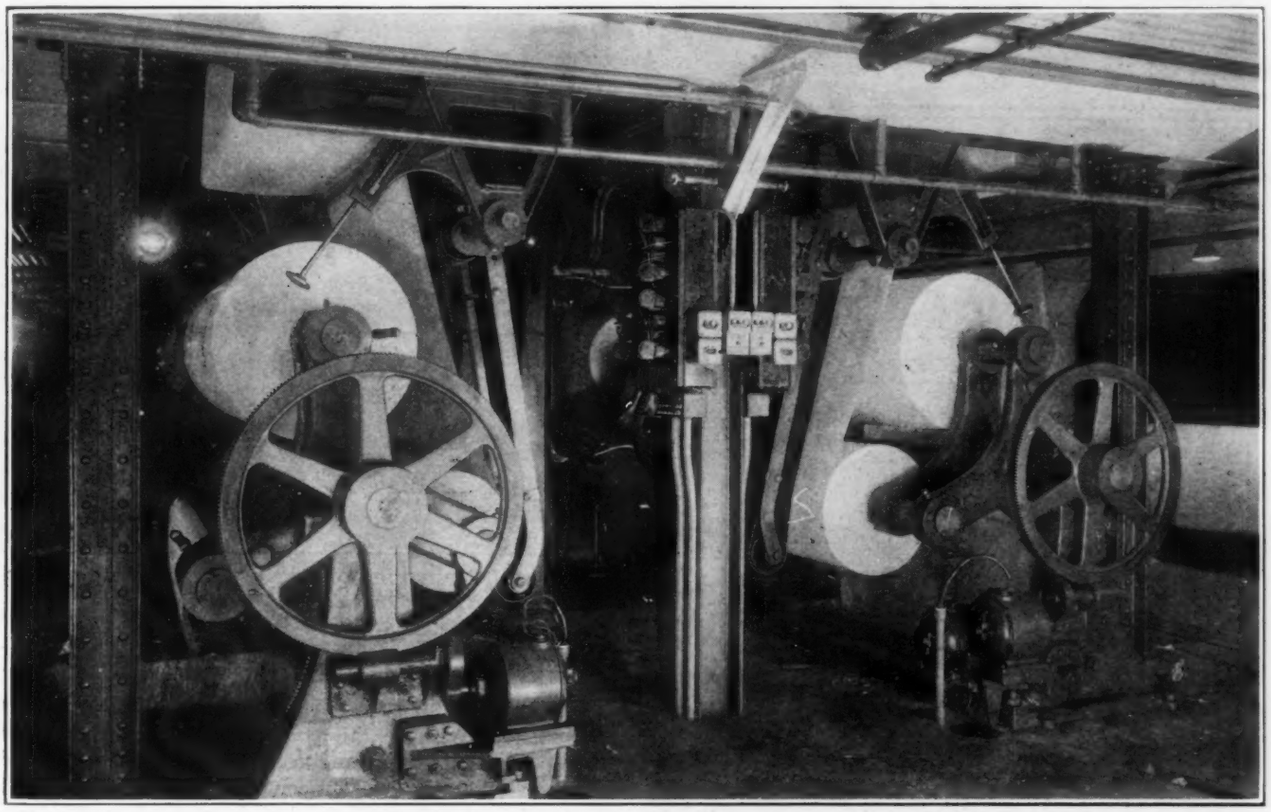


FIG. 1—PUSH-BUTTON CONTROL AND ELECTRIC DRIVE FOR REVOLVING PAPER REEL MAGAZINE AND ADJUSTING MARGINS (DETROIT "NEWS")

THE speed of the modern unit-type newspaper press ranges from 36,000 to 42,000 papers an hour, which means that the linear speed of the paper is approximately one-quarter of a mile a minute. When threading the paper through the press at the beginning of a "run" or edition, a constant low speed is required, of such value (about 2 or 3 per cent of maximum) that it permits the operator to pick up and lead the web through the cylinders and rollers without danger. To accomplish this the two-motor press drive and control equipment is used extensively. The starting motor generally has 10 per cent of the horsepower rating of the driving motor and operates through two gear reductions or a single chain reduction with a total ratio to the large motor drive of 20 to 1.

Considering the efficiency of each set of gears as 90 per cent, the total efficiency of the gear train is 81 per cent, giving 160 hp. torque at the large motor driveshaft. The torque is not sufficient for starting the press, as, due to the setting of the ink-distributing rollers and the pressure between the impression and plate cylinders, the required starting torque ranges from 200 to 300 per cent of the running torque. With alternating-current equipment the additional torque is often obtained by using a high-resistance squirrel-cage induction motor. With direct-current equipment the necessary torque is usually obtained by proper design of the armature resistance. The difference between the take-off speed and the threading speed depends upon the quality of the paper, the rate of acceleration and the speed of the paper. The take-off speed is usually about 70 r.p.m. for the plate cylinders.

PRESS DRIVES

Press drives of the early type were belt connected (using a tight and loose pulley), inching and slow speed being obtained by slipping the belt on and off the tight pulley. Later, with the introduction of the two-motor press drive, spur gears were used. With the development of the unit-type press many changes took place that affected the design of the two-motor press drive, with the result that the silent-tooth chain drive is now

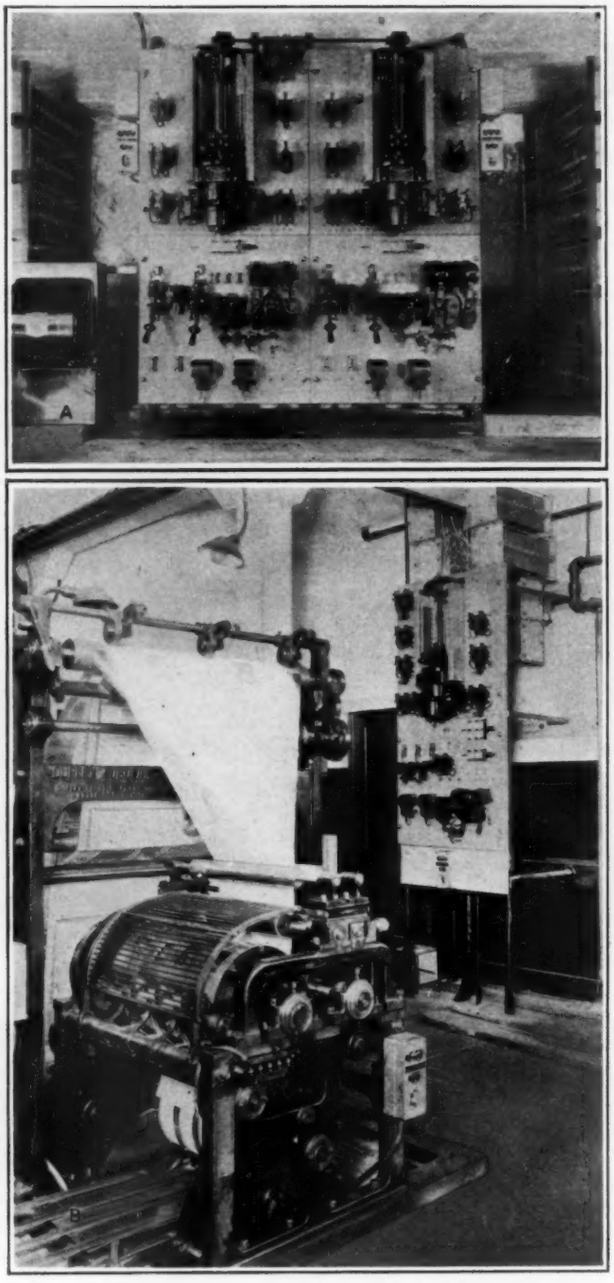


FIG. 2—FULL-AUTOMATIC DOUBLE-MOTOR CONTROLLERS

A—Direct-current installation with resistors for parallel operation of two presses (Chicago *Herald-Examiner*). B—alternating-current installation with resistors for sixteen-page tubular press (Evanston *News-Index*).

used in virtually all modern installations. The modern press-drive equipment consists of a double-bearing shaft that carries the silent-chain pinion, a gear train and over-traveling clutch with flexible coupling to the large driving motor.

CONTROL EQUIPMENT

One method of mounting two two-motor controllers to operate one press is shown in an accompanying illustration, they being situated on a balcony with a bank of resistors directly behind them. These controllers were designed to operate direct-current motors having 2½ to 1 speed range afforded by field control. The commutator and crosshead commutate the current through the armature resistance from the take-off speed up to the full-field or normal speed of the motor, being controlled by push-button stations at the press. As the crosshead ascends the field rheostat comes into play, increasing the speed of the driving motor by weakening the field. The crosshead is operated by a pilot motor through a specially designed clutch-driving mechanism, which stops the crosshead in a definite position with respect to each commutator segment and field button, preventing arcing and burning of contacts.

The same arrangement is used with alternating-current controllers, with the exception that the commutator segments are laid out for three-phase

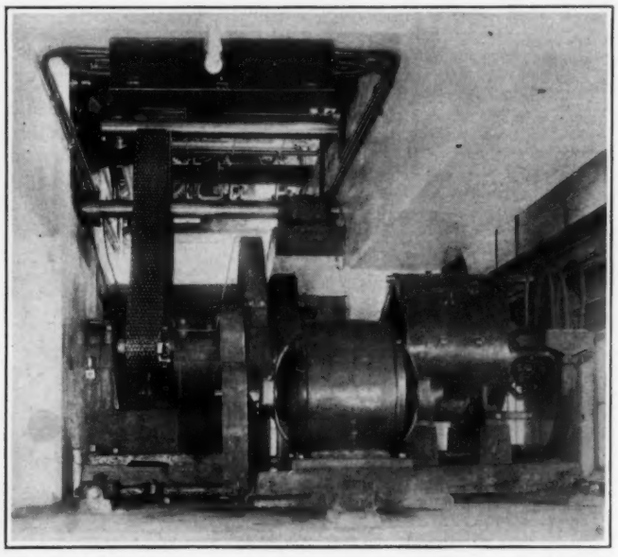


FIG. 3—60/5-HP. TWO-MOTOR DRIVE CONNECTED WITH PRESS BY SILENT CHAIN (DETROIT "NEWS")

resistance speed regulation of a large slip-ring motor. On the direct-current equipments the resistor is designed for 50 to 60 per cent speed reduction below normal, and on the alternating-current equipment 75 to 80 per cent speed reduction below full-load speed. On the alternating-current controllers is a torque switch that cuts out a few steps of resistance when the large motor switch comes in, to provide the necessary starting current for the large motor. After this operation the torque switch drops out, inserting part of the torque resistance.

The functions of the alternating-current and direct-current controllers are similar. For example, a push-button station contains five push-button elements and a snap switch, marked "On," "Off," "Stop," "Inch," "Reset," "Run" and "Safe." Pressing the "reset" button releases the "Safe-After-Inch" feature embodied in the control system, permitting the functioning of the other control buttons, and flashes the signal lights on the press by means of a relay and also sounds a horn or bell. Depressing the "inch" button closes a switch operating a small motor. A movement of $\frac{1}{8}$ in. on the plate cylinders can be obtained by inching. The "on" button causes the small motor switch to close, operating the press at threading speed. Each consecutive pressing of the "on" button causes the control crosshead to ascend step by step until the large motor is energized and takes the load away from the small motor through the over-traveling clutch. In sequence, the small motor switch drops out, applying the dynamic

brake to the small motor or the solenoid brake on the a.c. controller. The press may be accelerated to maximum speed by the use of the "on" button. Pressing the "off" button returns the crosshead to the starting position, decelerating the press. The "stop" button is used for a quick stop in case of a paper break or other mishaps about the press. When it is pressed, both small and large motor switches drop out and apply either dynamic braking on the direct-current equipment or the brakes on the drive of the alternating-current equipment. While the "safe" button is depressed, there is no response to depressing any of the other buttons in the station. Pressing the "run" button makes the system respond to the others.

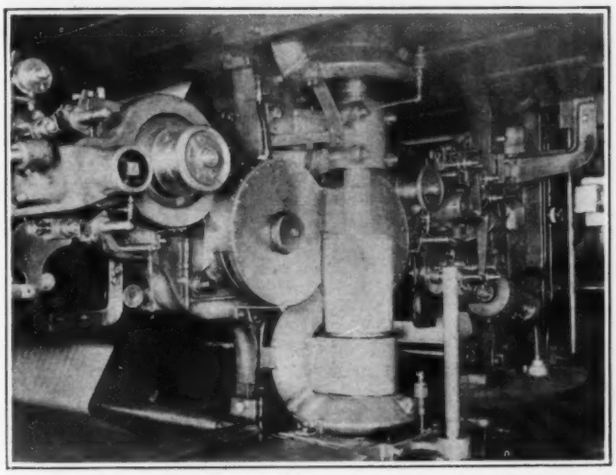


FIG. 4—MAGNETIC-TYPE BRAKES ON IMPRESSION CYLINDERS

Other types of control for small printing presses include the face-plate type and the two-motor semi-automatic type, in which the speed is regulated by means of a three-arm spider at the top of the panel. For certain classes of printing presses a single-motor, direct-current, 'full-automatic equipment can be used. The control functions are similar to the two-motor controller. The slow speed for threading and acceleration is obtained by means of an adjustable armature-shunt resistance and a torque resistance.

MULTI-UNIT CONTROL

Multi-unit control of unit-type presses has a very rapid but natural growth, providing greater flexibility in the combination of press units, quick change to other press units and one or two complete press drives and controls for reserve without holding any such equipment as spares. A great number of printing combinations are possible, two to six press units being operable from one drive and control equipment. The operating stations at the press units, the paper-break detectors, flashing relays and magnetic cylinder brakes are readily transferred from one printing combination to another by means of the transfer switches mounted on the transfer panel.

Press units can be operated by half the corresponding total number of drives and controls, but generally all but one drive is used, leaving one drive and control in reserve to be used in case of a breakdown on either drive or control. Any one of the drives can be thrown out by disengaging a jaw-clutch sprocket, leaving the press shaft free to rotate and not driving the reserve

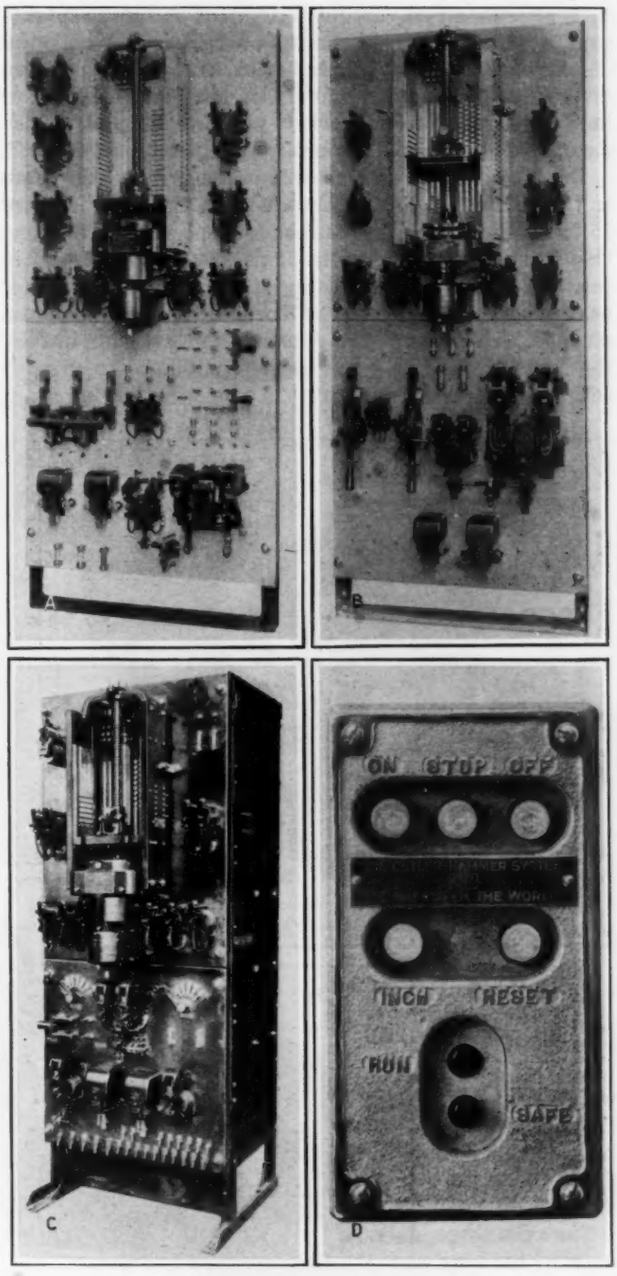


FIG. 5—TYPES OF FULL-AUTOMATIC CONTROL (WASHINGTON "STAR")

A—Alternating-current double motor. B—Direct-current double motor. C—Direct-current single motor. D—Push-button station for double-motor control.

equipment as a generator. For certain printing press combinations two press drives and controllers are interlocked mechanically and electrically for parallel operation. The control stations on the press, those at the folders and on the magazine reels (which are used to adjust the paper margin and reel tension), are commutated by means of transfer switches on separate transfer panels. The combinations are similar to the press combinations and are made at the same time for a given "set-up."

BRAKES

Presses operating at speeds of 30,000 papers an hour and higher require brakes on the impression or plate cylinders. The magnetic type, operated by the dynamic

current from direct-current equipment and by a separate generator unit on alternating-current equipment are quite generally used. These brakes are usually mounted directly on the extended shaft of the plate cylinder or impression cylinder of every printing couplet, which means that there are two brakes per press unit or deck.

During a test on a three-unit press, printing 24 pages at the rate of 42,000 papers an hour, the press coasted 25 seconds from the maximum speed in stopping. Using the dynamic braking alone, the press stopped in thirteen seconds, and using the magnetic cylinder brakes only, the press was brought to rest in eleven seconds. Using both the dynamic and cylinder brakes, the press stopped in seven seconds without groaning or whipping of the chain drive. The kinetic energy of each of the four cylinders of a press unit, operating at speeds which range from 300 to 400 r.p.m., varied from 4,000 to 6,000 ft.-lb.

The advantage of cylinder brakes are: (1) Absorption of the kinetic energy where it is stored, causing a more even distribution of the stresses; (2) less time lost in stopping the presses due to the paper breaking; (3) saving of newsprint which might otherwise be wasted.

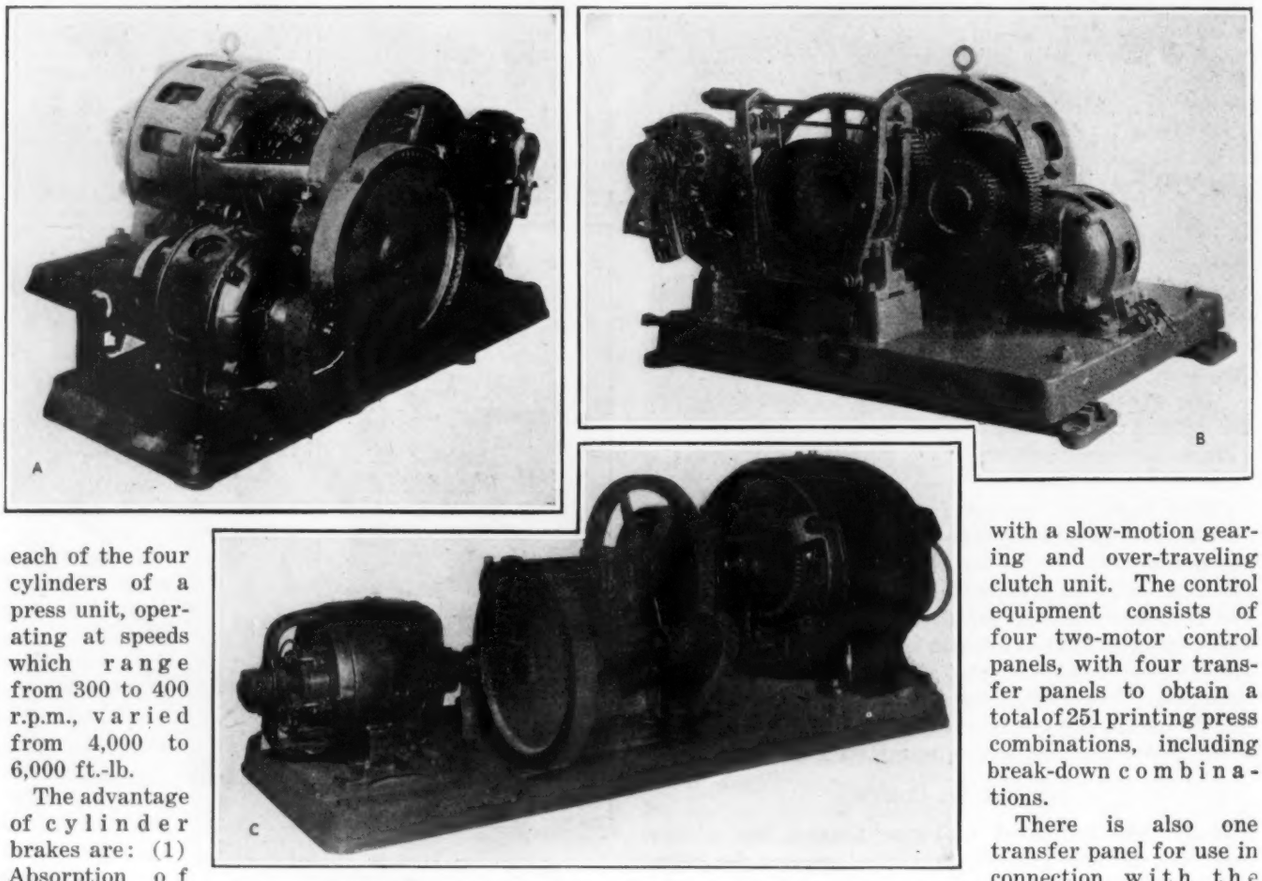


FIG. 6—TYPES OF TWO-MOTOR PRESS DRIVES AND BRAKES
A—40/5-hp. alternating-current drive with alternating-current brakes. B—25/3-hp. drive with motor-operated brakes. C—75/7½-hp. direct-current drive.

CONVEYORS

One type of newspaper conveyor receives the papers as they are delivered by the press (spaced four papers to the foot at a speed of about 150 ft. per minute) and delivers them on the mailing room delivery table stacked in counts of 50. The conveyor is driven by the press, therefore its speed is proportional thereto. An auxiliary motor with a gear reduction and clutch is used to empty the conveyor of papers after the press has stopped. The drive of the conveyor is arranged for three speeds—one that laps the papers four to the foot, a second lapping the papers two and one-half to the foot for "collect" runs, and a third that cuts out the conveyor beyond the folder connection and delivers the papers stacked close on the fly belts at the press delivery without passing through the conveyor.

MILWAUKEE "JOURNAL" INSTALLATION

The Milwaukee *Journal* installation consists of twelve superspeed press units of the low construction type driven by four press drives involving a silent chain connected to a jack shaft. Each drive is of the modern pedestal type, embodying a 125-hp., 2½ to 1 shunt, stabilizing-wound driving motor and a 10-hp. compound-wound starting motor, mounted on a common bedplate with a slow-motion gearing and over-traveling clutch unit. The control equipment consists of four two-motor control panels, with four transfer panels to obtain a total of 251 printing press combinations, including break-down combinations.

There is also one transfer panel for use in connection with the transfer of the push-button station on the magazine reels. A modern type, twenty-cylinder color press is operated by a 125/10-hp. drive of the same general construction as that used for the newspaper presses, with a corresponding control equipment. The controller is so arranged by means of a transfer panel that one of the controllers used for the newspaper presses can be used to operate the color press should a breakdown of its own control occur. Thus reliability of operation is assured without appreciable additional investment being made.

The signal system on all the presses consists of a flashing light interconnected with the control equipment for starting, accelerating and decelerating. A system of red lights is used to indicate when the press is "safe" for making necessary adjustments and when running.

Suggestion Plan as a Basis for Growth

Both Employees and Company Can Develop Most Rapidly if Proper Suggestion System Is Adopted, Believes Consumers Power Company—Features of Plan Being Inaugurated

ONE of the greatest problems that utilities have is developing employees into bigger positions, not only for the good reaction it has on the employees but because companies benefit most by building their personnel from within. One way that has been found successful and that is just being inaugurated by the Consumers Power Company is to have a suggestion system that will stimulate employees to think about ways of improving the company's practices. Worthy suggestions are publicly acknowledged and remunerated in proportion to their value.

Because suggestion systems that were not effective have been used by this and many other companies, but since it was still believed that a properly organized system would bring the desired results, the Consumers Power Company recognized that it must first ascertain the weak points of old suggestion systems.

Weaknesses of Old Suggestion Systems

Weaknesses found in old systems were the delay in acting on suggestions, the difficulty of fairly judging the values of diversified suggestions and the absence of power to act on some suggestions. These three weaknesses were found to be due to having too few judges, who were thus severely burdened with this work in addition to their regular duties and who furthermore could not be expected to judge the value of all suggestions that might be made. Executive appointment of a suggestion committee with power to act on the advice given by sponsor committees selected from men who were qualified to judge the value and practicability of different suggestions removed these weaknesses.

Individual and public recognition of meritorious suggestions by letter and bulletin notices, prize awards based on the value of suggestions, a mechanism for promptly explaining refusal of suggestions upon request and suggestions of types of ideas wanted constitute other essentials of a successful suggestion system.

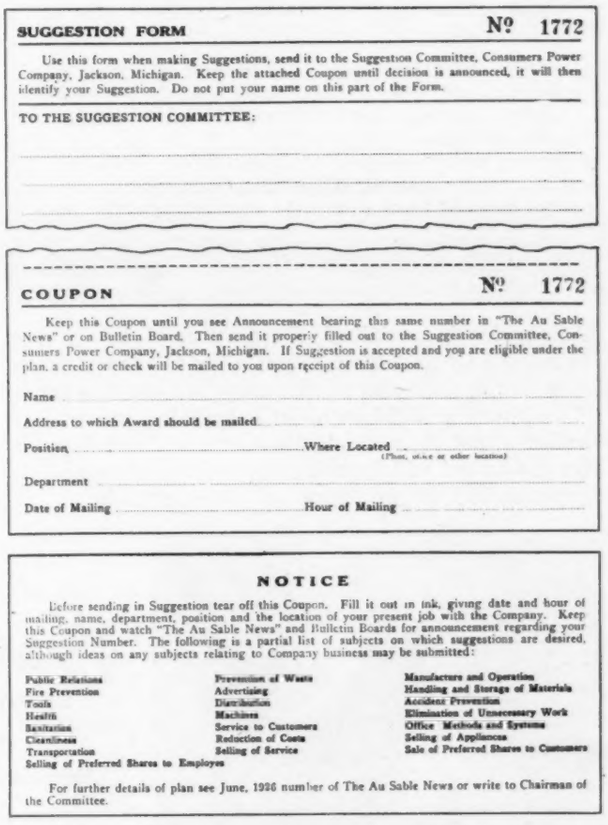
Inasmuch as the first application of this suggestion system is somewhat of a pioneering movement, the company has decided to go slowly and modify the system as conditions show it to be necessary.

For proper consideration of all suggestions they will be divided into groups by the suggestion committee. For each group a sponsor will be selected and a subcommittee suggested to save the sponsor time, although he can modify his committee. The sponsor is usually the head or assistant head of the department most affected by the suggestion and the remainder of the committee is composed of other department heads or semi-officials who are best qualified to determine the merits of the suggestion. Owing to the state-wide operations of the Consumers Power Company, it will be necessary to handle the sponsor committee work by correspondence or in some cases by telephone.

Awards for suggestions will, when possible, be based on estimated value of the adopted suggestion. If suggestions, after being placed in effect, prove to be worth more than the original estimated award, the committee has authority to review the case and recommend additional awards. When a suggestion contains merit, but does not warrant the minimum award of $5, a letter of appreciation and credit will be sent to the suggestor. Each such letter will be worth one or more credits based on the value of the suggestion, and when an employee has received a total of ten credits, he or she will receive $5.

Any suggestions relating to the company's business may be submitted, but the suggestion committee has prepared the following list of subjects to stimulate the most desired suggestions:

Improving engineering, construction or operating methods, service to customers, public relations, office



SUGGESTION FORM No 1772

Use this form when making Suggestions, send it to the Suggestion Committee, Consumers Power Company, Jackson, Michigan. Keep the attached Coupon until decision is announced, it will then identify your Suggestion. Do not put your name on this part of the Form.

TO THE SUGGESTION COMMITTEE:

.....

.....

.....

COUPON No 1772

Keep this Coupon until you see Announcement bearing this same number in "The Au Sable News" or on Bulletin Board. Then send it properly filled out to the Suggestion Committee, Consumers Power Company, Jackson, Michigan. If Suggestion is accepted and you are eligible under the plan, a credit or check will be mailed to you upon receipt of this Coupon.

Name .....

Address to which Award should be mailed .....

Position ..... Where Located .....
(Plant, office or other location)

Department .....

Date of Mailing ..... Hour of Mailing .....

NOTICE

Before sending in Suggestion tear off this Coupon. Fill it out in ink, giving date and hour of mailing, name, department, position and the location of your present job with the Company. Keep this Coupon and watch "The Au Sable News" and Bulletin Boards for announcement regarding your Suggestion Number. The following is a partial list of subjects on which suggestions are desired, although ideas on any subjects relating to Company business may be submitted:

Public Relations	Prevention of Waste	Manufacture and Operation
Fire Prevention	Advertising	Handling and Storage of Materials
Tools	Distribution	Accident Prevention
Health	Machines	Elimination of Unnecessary Work
Sanitation	Service to Customers	Office Methods and Systems
Cleanliness	Reduction of Costs	Selling of Appliances
Transportation	Selling of Service	Sale of Preferred Shares to Customers
Selling of Preferred Shares to Employes		

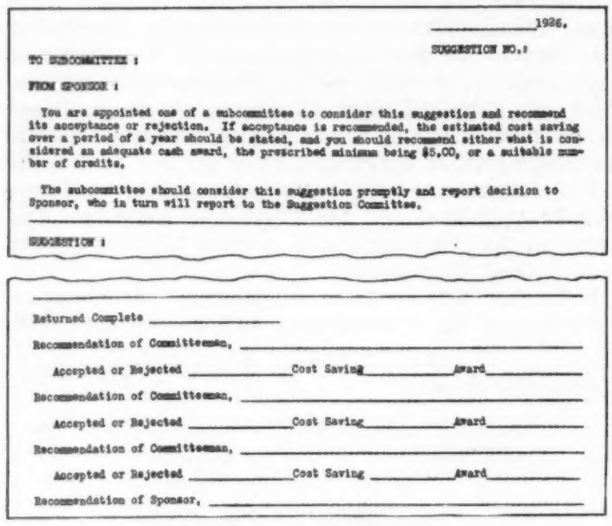
For further details of plan see June, 1926 number of The Au Sable News or write to Chairman of the Committee.

SECRET SUGGESTION FORM AND IDENTIFICATION COUPON

The back of the form that is kept by the suggestion committee has space for indicating: Date and hour received, when referred to sponsor and sub-committee, date returned and decision.

methods and systems, tools and machinery, safety conditions, health and working conditions of employees and plans for customer and employee ownership of securities. Eliminating waste of every kind, hazards to life or property and unnecessary work. Increasing sales of service and appliances.

Each suggestion must be submitted on a special numbered "suggestion form," like that illustrated. When an employee has several ideas or suggestions, they must be submitted on separate forms. Suggestion forms can be obtained from boxes installed in various places around the company property or from the suggestion committee. To enable concealing identity of suggestors each suggestion form has a coupon attached carrying the same number as the suggestion blank. The coupon is retained by the suggestor until announcement is made of action on the suggestion, which is indicated by number. Before a suggestion receives an award, the coupon must be filled in and forwarded to the committee.



_____1926.

SUGGESTION NO.:

TO SUBCOMMITTEE:

FROM SPONSOR:

You are appointed one of a subcommittee to consider this suggestion and recommend its acceptance or rejection. If acceptance is recommended, the estimated cost saving over a period of a year should be stated, and you should recommend either what is considered an adequate cash award, the prescribed minimum being $5.00, or a suitable number of credits.

The subcommittee should consider this suggestion promptly and report decision to Sponsor, who in turn will report to the Suggestion Committee.

SUGGESTION:

Returned Complete _____

Recommendation of Committeeman, _____

Accepted or Rejected _____ Cost Saving _____ Award _____

Recommendation of Committeeman, _____

Accepted or Rejected _____ Cost Saving _____ Award _____

Recommendation of Committeeman, _____

Accepted or Rejected _____ Cost Saving _____ Award _____

Recommendation of Sponsor, _____

SPONSOR COMMITTEE FORM

On this form, which is sent to the sponsor committee, the suggestion committee fills in the suggestion number, the personnel of the sponsor sub-committee and the suggestion made. At the bottom is space for the decision of the sponsor committee, the estimated yearly saving that will be effected, the award recommended and the recommendation and signature of the sponsor.

As previously explained, the purpose of this system is to remove all friendship or prejudice in the consideration of suggestions and to encourage persons who might feel backward or diffident about submitting suggestions. Whether or not the name of the suggestor is made public after the award will depend upon the importance of the suggestion and the preference of the suggestor.

The suggestion system has been in force only since June 15, 1926. Up to July 1 a total of sixteen suggestions had been received. Action had been taken on eleven of these suggestions; two have been given cash awards, four have been awarded credits and five could not be accepted. At the date of this writing, there has not yet been time for the necessary investigation of the merits of the remaining five suggestions.

With this interest shown at the outset and the possibilities of increasing interest as the idea becomes more generally understood and appreciated, the Consumers Power Company expects to benefit from the ideas that have hitherto been latent in its employees' minds, and most important of all, the employees will benefit directly in cash awards, public recognition and a broader perspective which comes from taking a deeper interest in various activities of the company.

Providing Take-Offs for Outgoing Transmission Circuits

UNUSUAL care has been taken at the Essex Junction plant of the Burlington (Vt.) Light & Power Company to provide adequate "take-offs" for outgoing transmission circuits, the importance of first-class mechanical and electrical construction being realized from the standpoints of service reliability and safety in operation. The features shown contrast with the makeshift methods so often found in circuit take-offs in hydro-electric stations located in areas where wood is cheap and the temptation great to build rough-and-ready structures for this purpose.

Wall Bushing, Vertical Risers and Dead-End Structure for Station Entry

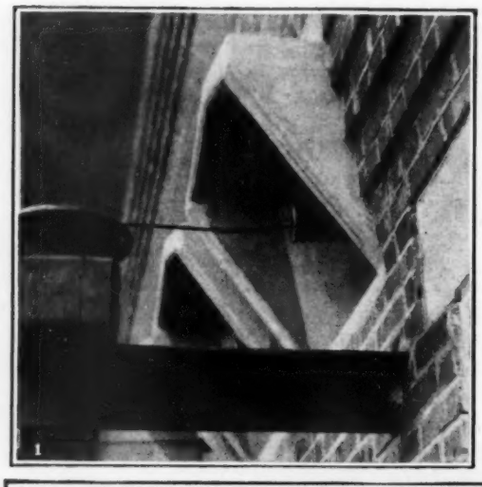


Fig. 1 shows the wall-bushing design for taking the phase wire out of the station, the bushing being in a concrete hood for moisture protection, the outgoing conductor terminating on a pin-type insulator carried on a bracket attached to the wall as shown in the illustration. From the insulator each phase wire passes to a fitting at the top of a strain insulator string of the suspension type, whence it makes a right-angled turn (Fig. 3) and passes upward to a strain-insulator string on the steel roof structure shown in Fig. 2, where another right-angled turn carries the line away from the plant to the towers or poles of the outside transmission. The method of attaching these insulators to their mechanical supports is both convenient and rugged.

System Interconnection*

Functions of Intercompany Tie-Lines and Classifications—Applications and Methods in Chicago District—An Operating Difficulty on an Interconnection Covering a Wide Area

By H. B. GEAR
Assistant to Vice-President Commonwealth Edison Company, Chicago

THE interconnection of great electric utility systems presents a picture that varies greatly in its beauty and attractiveness according as it is viewed through the eyes of the impractical idealist, who sees therein a wonderful system of superpower lines, destined to bring about social reconstruction (and incidentally political advantage), or, on the other hand, through the eyes of the practical system operator, on whose shoulders rests the responsibility for making the dream of the idealist a working reality. It remains for engineers to be the practical idealists who can face the problem and produce an economically sound solution of it. It is with this thought in the background that I venture to set forth some of the essential facts and factors of the process known as interconnection.

The interconnection of power stations within the limits of a city has been considered desirable practice since an electric utility system was big enough to have two stations within practicable distance of economical interconnection. The capacity of the early lines was small as measured by the yardstick of present-day standards, as were the stations.

With the introduction of three-phase circuits and the growth of power station ratings, the capacity of tie-lines has steadily grown in the past 25 years from circuits of less than 1,000 kva. up to present-day lines of more than 50,000-kva. capacity. It is the growth in size that, in turn, has called for increased voltage. This has permitted interconnection at greater distances and, in turn, has precipitated upon us the problems with which we find ourselves confronted at this time.

Humanly speaking, we are in much the same class as the lad who is suffering with pains caused by too rapid growth. Just as the lad is helpless in reducing the rate of growth, so we are driven into a situation that is not entirely of our own choosing.

WHY INTERCONNECT?

In the case of the boy, we don't think of killing him off to stop the pains, because there is promise that the lad will become a strong and useful man when he has reached his maturity. And so we cannot say we will stop interconnecting to avoid the resulting troubles, because we can see ahead material advantages which we cannot afford to be without.

What are some of these advantages? They may be placed in two general classes:

1. Economy of plant investment.
2. Economy of plant operation.

ECONOMY OF PLANT INVESTMENT

By making an investment per kilovolt-ampere in tie-lines of something less than the cost per kilowatt of capacity of the power station we can make available in either of the stations so interconnected the surplus or reserve capacity of the other.

In the larger cities, the situation at present (and for the future it will be much aggravated) is that the stations built in earlier years, to be somewhat central to the load areas supplied by them, have now reached their maximum possible size due to water conditions, area of land available or other causes, and cannot be developed further.

Nevertheless, the load in the area to which these stations are nearest continues to grow apace and provision must be made to produce this excess of energy in a newer station more remotely located. This at once calls for tie-lines of the largest practicable capacity between the station where additional capacity is being provided and the station on which excess load is being added.

Investment economy results if the cost of tie-lines is not excessive, since the generating units in the new station are taking care of growth in more than one part of the city and are, therefore, chosen to be of the largest size consistent with the load of the whole system. Larger size means lower cost per kilowatt of capacity.

The tie-lines should be of somewhat larger capacity than the deficiency at the receiving station, in order to permit the operation of the units in the receiving station at somewhat less than their rated capacity during peak hours, thus retaining a higher degree of security in case it should be necessary to take a unit out of service on short notice.

Without tie-lines in such a situation, it would be necessary to run direct lines from the more distant newer station to take the growth of load in the area of the older station. Unless the geography of the situation is such as to favor the creation of a new wholesale center of distribution, the interstation tie-line is usually the most economical procedure.

Where there are two power stations under development within a practical radius of transmission, the presence of an interconnecting line permits the selection of the largest practical size of units with the minimum practical percentage of reserve, thus producing economy in total plant investment from year to year. Were each plant to be developed independently, the percentage of reserve would be doubled in the average case and the unit cost of development would be appreciably higher.

The generating units of each station require an annual inspection and overhauling, which work is usually scheduled for the six summer months, when the peak loads are smaller. With suitable interconnections, the progress of such work is not only greatly facil-

*Based on a paper presented by author before the N.E.L.A. electrical apparatus committee, Chicago, Oct. 14, 1926.

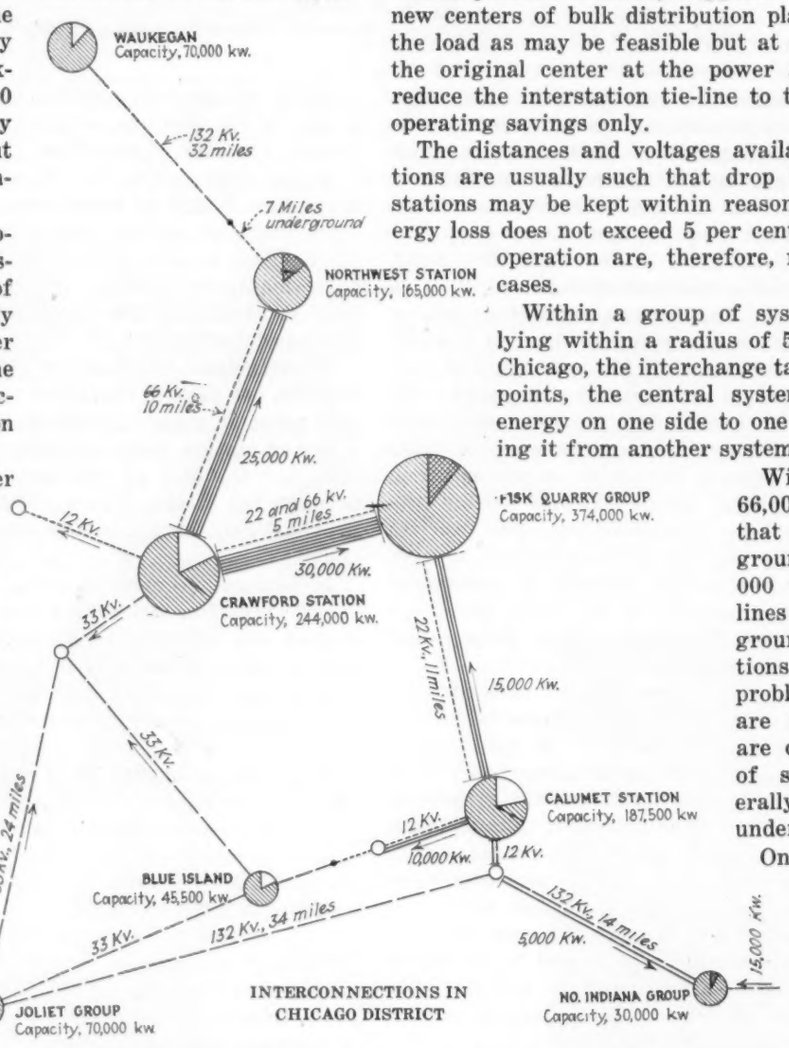
itated but it can be safely prosecuted with a smaller percentage of total reserve in the system.

Thus economy of plant investment results where suitable interconnecting lines are provided, because of (a) lower costs per unit of capacity and (b) smaller percentages of reserve capacity.

In the Chicago district it is estimated that the saving due to lower costs per kilowatt on the generating capacity installed during the past five years has been $5,000,000 to $6,000,000. The saving in reserve capacity installed during the same period is probably an equal amount, making a total of $10,000,000 to $12,000,000 saved by the installation of about $4,000,000 in interconnecting lines.

The savings in production cost made possible by the transfer of energy from more highly efficient plants to older stations is one of the most important functions of interconnection facilities.

The older and smaller units perform a useful function as peak capacity needed only for a few hours in the day during winter months, but their operation during long hour loads is an economic waste, which should not be countenanced, if it can be avoided. Tie-lines are justified from new stations to the older ones for this reason alone, in many cases, whether or not there is a deficiency in capacity or reserve.



INTERCONNECTIONS IN CHICAGO DISTRICT

This applies as well to the stations of neighboring companies as to those operating under the same management, and it becomes a practical working arrangement when both parties recognize that such transfers of energy are merely interchanges and not sales of energy and make their business agreements accordingly. This has been done in the Chicago group of utilities in a way that is advantageous to all of the participating companies and their consumers.

Interconnection Problems

The problems arising in connection with interconnection of stations and systems vary with a wide range of circumstances. They may be classified under three general heads as problems of interconnection: (a) within a single system; (b) within a group of systems under allied management; (c) between neighboring groups under separate management.

Within a given system distances are short, loads to be transferred are heavy and voltages of transmission are usually lower than in other situations.

One of the serious problems in such cases is to find space on an older property, which is fully developed, for the necessary terminal transformers and switches and for the extension of the switch-house to receive additional outgoing distribution circuits needed to care for the growth in load.

This problem naturally suggests the establishment of new centers of bulk distribution placed as centrally to the load as may be feasible but at some distance from the original center at the power station. This may reduce the interstation tie-line to the requirements of operating savings only.

The distances and voltages available for such situations are usually such that drop in voltage between stations may be kept within reasonable limits and energy loss does not exceed 5 per cent. The problems of operation are, therefore, not serious in such cases.

Within a group of systems, such as that lying within a radius of 50 to 60 miles from Chicago, the interchange takes place at various points, the central system often delivering energy on one side to one system and receiving it from another system on the other side.

With voltages up to 66,000 available for lines that are wholly underground, and up to 132,000 volts for overhead lines having underground terminal connections, the operating problems of such groups are largely those that are common to the use of such voltages generally and are quite well understood.

One of the most important operating problems in such a group is that of co-ordinating the output of generating stations.

In the Chicago district the interchange of energy among the stations of the various members of the group is supervised through an intercompany committee of load dispatchers, which meets periodically to discuss the requirements of their respective companies and arranges schedules of energy transfer that fit into the overhauling programs of each and take proper account of seasonal variations of system loads from month to month.

This committee also arranges for withdrawal of generators and interconnecting lines from service when necessary for construction or maintenance work. These load dispatchers are thus continuously so informed as to which stations have reserve capacity that they know where to look for prompt relief in case an emergency should arise.

The various conditions above described are illustrated in the accompanying diagrams, showing the general arrangement of generating stations and tie-lines in the

Chicago district as they will be during the coming winter.

The relative size of the station groups is indicated by the diameter of the circles. The station groups having surplus capacity have a clear sector proportional to their reserve, and those having a deficiency have a darkened sector, which is likewise proportional to the deficiency.

The voltage and length of the tie-lines are indicated in each case, the short-dashed lines being underground and those made up of longer dashes being overhead.

The solid black lines between stations show the load transferred from the stations having excess capacity to those having deficiencies, and each line represents 5,000 kw. of transferred energy.

The stations that must receive energy from other points are those developed in earlier years, which have now reached their limit until rebuilt with larger units. The lines running west from Crawford Avenue supply energy to substations of another company for use in suburbs, which are most economically supplied from Crawford Avenue.

Neighboring System Tie Problems

Interconnection between neighboring systems usually involves longer distances, higher voltages and the transfer of relatively smaller amounts of energy. These conditions introduce problems of voltage control and interchange of synchronizing currents that sometimes require special treatment in the form of voltage ratio adjusters on transformers, or synchronous condensers, as well as means of observing the interchange conditions continuously.

Means of intercommunication by telephone between points of control in the different systems are a very necessary adjunct.

An interesting and unusual example of this class of interconnection is that made during the last summer between the Chicago district and the system of the American Gas & Electric group in Indiana and Ohio. This connection was made at the boundary between the territory served by the Northern Indiana Public Service Company, east of Michigan City, Ind., and that of the Indiana & Michigan Power Company, with headquarters and a power station near South Bend, Ind.

At times of full load this line is connected to the lines of the Ohio Power Company on the east, which, in turn, operates in parallel with plants in Cleveland, Wheeling, and Pittsburgh, having more than 1,000,000 kw. installed capacity. At the Chicago end it terminates at Calumet station and is in parallel with the entire Chicago system, aggregating more than 1,000,000 kw. of installed capacity.

The Northern Indiana Public Service Company contracted to take 5,000 kw. from demand from the Indiana & Michigan Power Company under conditions that require parallel operation of the two systems continuously, if possible, in order to insure a continuous supply of energy at Michigan City and intermediate points.

Difficulty has been experienced in keeping the two groups in parallel, because of the periodic swings of energy, which occasionally go beyond the maximum allowable relay settings and open the tie-line. Means were provided for enabling turbine operators to observe the amount and direction of flow of energy, but the swings are too rapid to prevent separation before load adjustment by governor control can be applied. Further study to seek the remedy is in progress.

Suggests Uses by Example

In Erecting New Headquarters United Light & Power Company Endeavors to Practice What It Preaches Regarding the Use of Electricity

By W. H. Snider
Electrical Engineer United Light & Power Engineering & Construction Company, Davenport, Iowa

THE new office building at Davenport, Iowa, housing the operating headquarters of the United Light & Power Company and the local offices of the Peoples Light Company and Tri-City Railway Company, may be interesting for several reasons. First, by locating the headquarters of the holding company at Davenport, Iowa, the center of one of its largest subsidiary properties (instead of in a larger commercial and financial center such as Chicago) and by arranging to house it in the same building with the local electric power and traction subsidiaries the company was financially justified in erecting a building for its exclusive use that might not have been justified otherwise in Davenport for a local utility alone. This building is equipped with all the electrical applications in the form of light and power which it advocates to customers. More than this, it has endeavored to apply them in an exemplary way, of which the lighting is the most striking.

ILLUMINATION OF BUILDING EXTERIOR WITH FLOODLIGHTS

In providing the equipment the company avoided being partial to any manufacturer. As a result the building can be shown to architects, prospective builders and office lessees by the utility salesmen or jobbers and retail dealers to indicate what can be done with electricity under different conditions. Practically every type of lighting is to be found somewhere in the building. The selection was determined by the ability to display the fixtures to their best advantage.

Floodlighting is provided by ten 1,000-watt projectors on one side of the building and twelve 1,000-watt projectors on another side. The projectors are mounted in such a way as to cut off light that might enter the sales-floor show windows and thus prevent the utilization of color lighting in the windows. Glare on the street is eliminated by cutoff screens on the projector racks.

On one side of the building there is a special inclosed show window illuminated to the high intensity of 75 to 100 ft.-candles. To provide this illumination 23 200-

watt Mazda lamps and X-ray No. 510 reflectors are used in this window. The remaining seven show windows are equipped with X-ray No. 410 reflectors with color screens and 150-watt lamps. The reflectors are inclosed in a walnut case so that the appearance from the show room will be more sightly. Special louvered color screens are used in the corner windows to cut down any cross-reflection between the two banks of lights.

In the main lobby, which is finished in Italian marble, is a bronze lantern having eight plate-glass panels and equipped with eight 25-watt frosted lamps.

Off from the lobby is the main sales floor, which is illuminated by cast-bronze luminaires with brownish tinted art-glass bowls. Inside each bowl is an X-ray reflector and a 1,000-watt stem-frosted Mazda lamp. The bowls, which are 24 in. in diameter, are supported 5 ft. below the ceiling. Virtually shadowless illumination is obtained with this type of luminaire, the intensity being of the order of 15 ft.-candles.

A special design of cast-bronze bowl, 18 in. in diameter, with panels of glass similar to those in the main salesroom, is used over the balcony. This luminaire, which has eight glass panels, contains a 300-watt stem-frosted lamp.

To have ample room for displaying appliances, stoves, lamps and so forth, it was found desirable to build a sales floor annex in the basement. In the center of each ceiling bay, which is vaulted, is hung an ornamental Ivanhoe Trojan decorated luminaire containing a 500-watt lamp.

In the accounting department on the mezzanine floor Sol-Lux 200-watt lighting units are spaced 10x12 ft. apart, the ceiling height being 9 ft. 8 in. In the securities department, also on this floor, Western Electric No. 9910 ceiling-type units using 150-watt lamps with a spacing of 10x9 ft. 6 in. are used. No difficulty from glare has been caused by the use of these direct units and large lighting sources, inasmuch as relatively large inclosing globes are used. Consequently the surface brightness of the globes is kept down to a comfortable value. Some shadows can be noticed in the direct-lighted room, but they are not objectionable. The walls and ceilings of the offices, illuminated by direct lighting, are of white hard-finished plaster.

On the fourth floor Holophane lighting units of the inclosing reflector-refractor or Filterlite type are used in the offices. Direct lighting is also employed in the chemical laboratory, where Western Electric No. 9910 units containing 150-watt lamps, spaced on 9x10-ft. centers, are used.

MAIN SALES FLOOR RECEIVES 15 FT.-CANDLES ILLUMINATION FROM ORNAMENTAL LUMINAIRES

A more expensive type of lighting is used in the private offices throughout the building. In the majority of private offices are installed luminous bowl or completely indirect units. Most of these units were furnished by the Curtis Lighting Company. Several of the private offices are illuminated by means of silver indirect bowls, which produce an even intensity of illumination.

A few of the electromechanical features may be of interest. General Electric gearless-traction elevators are employed, which have a car capacity of 2,500 lb. and a speed of 600 ft. per minute. They are equipped with the latest safety devices and automatic leveling.

Johns-Manville underfloor fiber duct makes the communication circuits readily accessible throughout the building. A complete system of dictograph intercommunicating telephones and 26 dictograph stations throughout the building, including two master stations with loud speakers and signaling equipment, are other features.

Division of Load in Three-Phase Transformer Banks

Cases Commonly Met With in Practice Where Lighting and Power Are Taken from Same Transformer Bank Analyzed—Effect of Unbalanced Loads on Transformer Rating—Voltage Regulation Considered in the Study

By H. S. LANE

Assistant to Engineer of Operation Pacific Gas & Electric Company, San Francisco, Cal.

IN THE experience of all electric distribution engineers a number of problems arise relative to the distribution of unbalanced loads and loads at different voltages supplied from three-phase banks connected in one or another of the standard ways. The solution of these problems, necessary to determine the required transformer capacities for safe operation, are not casually apparent. The following discussion is intended to present certain of these problems and their solution in concrete and practical form.

Solution of such problems by vector diagrams has the advantage of presenting a readily comprehensible picture of the magnitude and relation of the several factors involved not afforded by mathematical solutions, while providing sufficient accuracy for practical purposes. In the solution of such diagrams it is essential

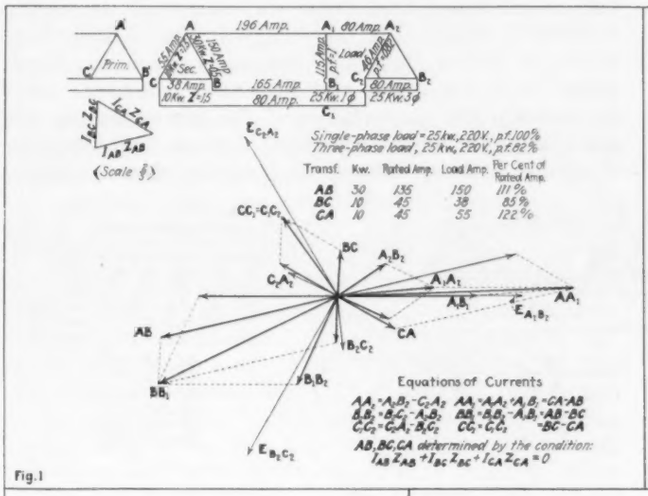

Single-phase load = 25 kw., 220 V., p.f. 100%
Three-phase load, 25 kw., 220 V., p.f. 82%
Transf. Kw. Rated Amp. Load Amp. Per Cent of Rated Amp.
AB 30 135 150 111 %
BC 10 45 38 85 %
CA 10 45 55 122 %
Equations of Currents
AB, BC, CA determined by the condition:

Fig. 1

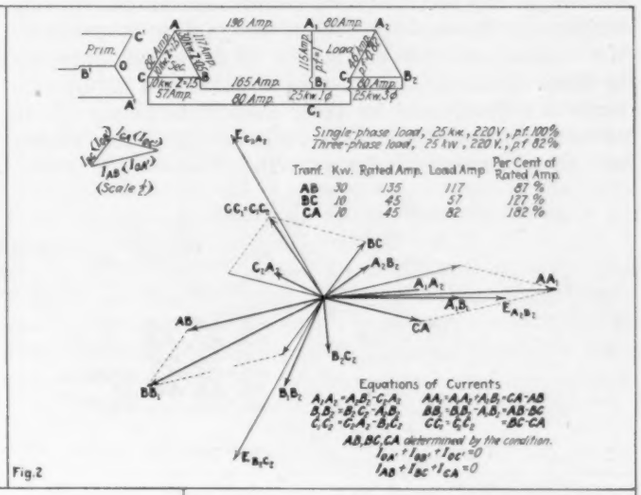

Single-phase load, 25 kw., 220 V., p.f. 100%
Three-phase load, 25 kw., 220 V., p.f. 82%
Transf. Kw. Rated Amp. Load Amp. Per Cent of Rated Amp.
AB 30 135 117 87 %
BC 10 45 57 127 %
CA 10 45 82 182 %
Equations of Currents
AB, BC, CA determined by the condition.

Fig. 2

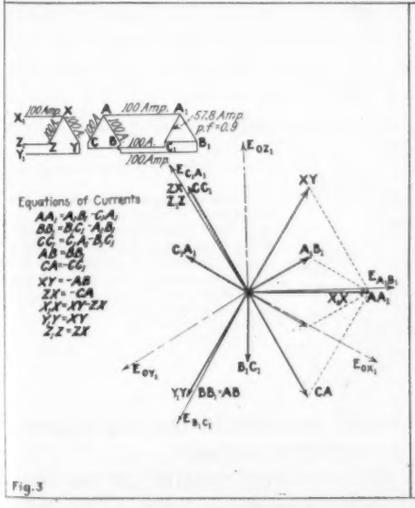


Fig. 3

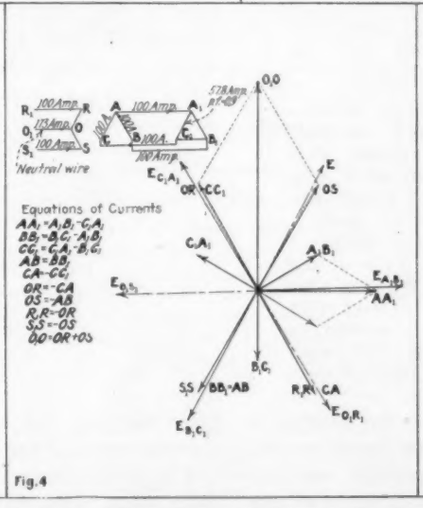


Fig. 4

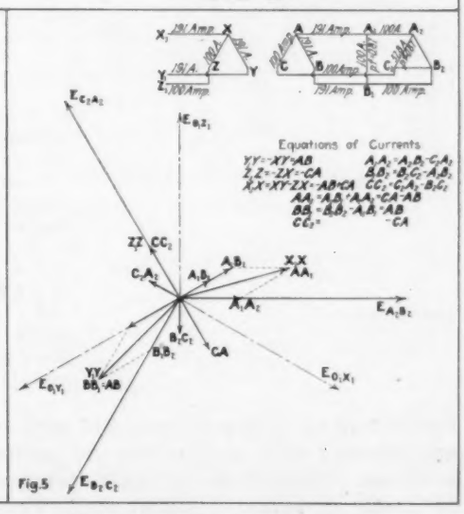


Fig. 5

FIGS. 1 TO 5—VECTORS PRESENT MORE COMPREHENSIBLE PICTURE THAN MATHEMATICAL ANALYSIS

Fig. 1—Division of unbalanced load in bank of transformers of unequal size. Primary connected delta.

Fig. 2—Division of unbalanced load in bank of transformers of unequal size. Primary connected star, secondary delta.

Fig. 3—Division of load in open delta transformer bank with balanced three-phase load.

Fig. 4—Division of load in open star transformer bank with balanced three-phase load.

Fig. 5—Division of load in primary supplying open delta bank with unbalanced load.

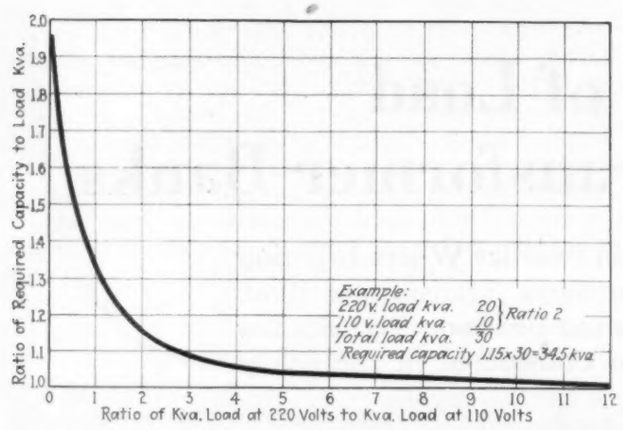

Ratio of Required Capacity to Load Kva.
Ratio of Kva. Load at 220 Volts to Kva. Load at 110 Volts
Example:
220 v. load kva. 20
110 v. load kva. 10
Ratio 2
Total load kva. 30
Required capacity 1.15 x 30 = 34.5 kva.

FIG. 6—EFFECT UPON REQUIRED TRANSFORMER CAPACITY OF VARYING THE PROPORTIONS OF 220-VOLT AND 110-VOLT LOAD SUPPLIED FROM SAME THREE-PHASE TRANSFORMER BANK (DELTA SECONDARIES), THE POWER FACTOR OF BOTH LOADS BEING THE SAME

that a proper nomenclature and convention for the designation of the vectors must be consistently adhered to and that the equations of the vector relations be written completely and in conformity therewith. In the accompanying diagrams each point in the connection diagrams is lettered, and the vectors of voltage and current in any section of the circuit are denoted by subscripts—for example I_{AB}, E_{AB}, designating respectively the current and voltage from A to B. (For simplicity in these diagrams, where no confusion can occur, currents are designated by their subscripts only.) Note particularly that $I_{AB} = -I_{BA}$, $E_{AB} = -E_{BA}$. Lag angles are shown counterclockwise. In all cases the transformer and line losses are assumed zero, as the diagrams are intended only to illustrate the major fundamental relations. They have all been substantially verified by tests of actual installations. Transformers are assumed unity ratio for the purposes of these illustrations. The function of the dotted lines in illustrating the addition (or subtraction) of vectors is obvious.

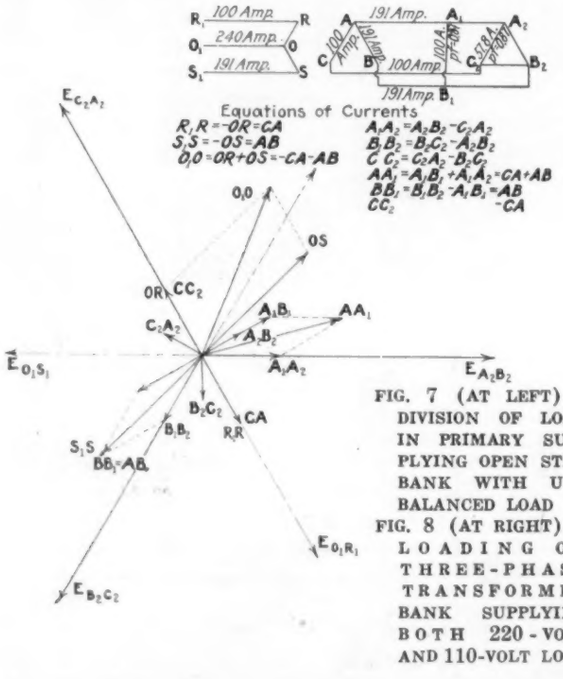

Equations of Currents
R₁R = -OR = CA
S₁S = -OS = AB
O₁O = OR + OS = -CA - AB
A₁A₂ = A₂B₂ - C₂A₂
B₁B₂ = B₁C₂ - A₂B₂
C₁C₂ = C₂A₂ - B₂C₂
AA₁ = A₁B₁ + A₁A₂ = CA + AB
BB₁ = B₁B₂ - A₁B₁ = AB - CA
CC₂

FIG. 7 (AT LEFT)—DIVISION OF LOAD IN PRIMARY SUPPLYING OPEN STAR BANK WITH UNBALANCED LOAD

FIG. 8 (AT RIGHT)—LOADING OF THREE-PHASE TRANSFORMER BANK SUPPLYING BOTH 220-VOLT AND 110-VOLT LOAD

The first case, the division of unbalanced load in a bank of transformers of unequal size, presents two distinct problems: first, with transformer primaries connected delta, and second, with primaries connected star (neutral free). In Fig. 1, covering delta primary, it is to be noted that the criterion for solution is that the vector sum of the impedance drops in the bank is zero and that therefore with the relation of transformer impedances approximately inversely as their capacities the division of load in the transformers is roughly the same as the loads in the respective phases, in spite of the difference in phase of the load components assumed.

In Fig. 2, primary star, the criterion for solution is that the vector sum of the currents at the primary neutral, and consequently of the currents in the transformer secondaries, is zero. In this case both of the smaller transformers are overloaded, that in phase CA seriously so, due to the difference in load power factors. Regardless of the sizes and impedances of the transformers, the component of the single-phase load in transformer AB is two-thirds and in transformers BC and CA is one-third of that load. Obviously care must be exercised to provide transformers of adequate capacity in the latter two phases. The curves of Fig. 9 afford a means of approximately determining the required transformer capacities of a bank to supply such a combined load from star-connected primaries. It must be noted that these curves apply exactly only where the power factors of the single-phase and three-phase loads are equal, and reasonable allowance must be made in the sizes chosen if the power factors are materially different. In these and in the following diagrams it is of interest to note the phase displacement between the several currents in the transformer secondaries and their respective voltages.

Fig. 3 illustrates the relations existing in an open delta bank with balanced three-phase load. The load supplied is 86.7 per cent of the required transformer capacity. It is of particular interest to note the equality both in amount and phase displacement of the

primary line currents. (The primary star voltages are shown as E_{Ox}, etc.) Fig. 4 covers an open star bank with balanced three-phase load. The same relation holds regarding load and required transformer capacity. The definite undesirability of this arrangement on account of the distorted phase relations and voltage drop, due to neutral current in the primary, is plainly indicated in the diagram. Fig. 5 and Fig. 7 illustrate

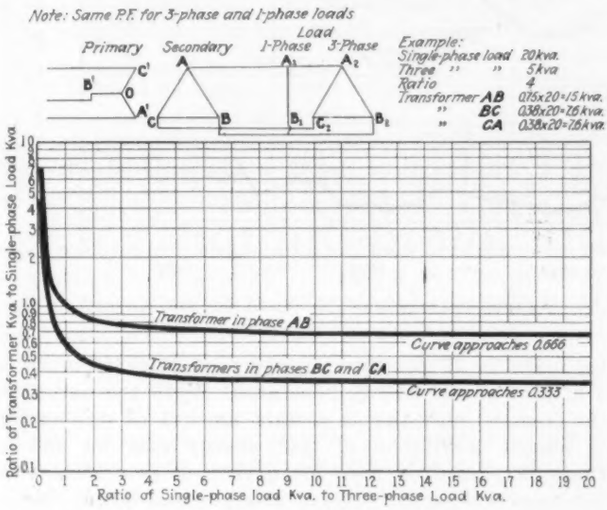


FIG. 9—REQUIRED TRANSFORMER CAPACITY FOR COMBINED SINGLE AND THREE-PHASE LOADS WITH STAR-CONNECTED PRIMARY

the conditions where an unbalanced load is supplied by an open delta and an open star bank respectively. In general the same comments apply.

A problem that presents itself occasionally is the supply from one transformer bank three-phase loads at full secondary voltage and half voltage from the mid taps. The determination of the required transformer size is an interesting and somewhat complicated problem. Fig. 8 illustrates the case of balanced three-phase loads at 220 volts and 110 volts. The required transformer size is, of course, determined by the maximum current in any half coil. In general, the currents in the two halves of the transformer are not the same. The component of each line current in each transformer half coil equals 57.8 per cent of said line current; the angles between the two components are 60 deg. plus and minus the difference in phase angles of the two loads in the respective half coils. From this general relation it is possible to determine the required capacity in any case without the necessity of working out the complete vector diagram. Fig. 6 shows the relation of required bank capacity to load kilovolt-amperage as the proportions of the full-voltage and half-voltage loads are varied, provided their power factors are the same. By making due allowance for any material difference in power factors of the two loads this curve affords a ready practical solution for such problems.

Other problems of similar nature—for instance, the addition of a three-phase load to an unbalanced three-wire single-phase load—can be similarly solved with relative ease and certainty if the process outlined is carefully and consistently followed. The losses in the lines and transformers can, of course, be accounted for, but the added complications imposed by their inclusion are not warranted by the practical purposes sought.

August Gains Equal the Half-Yearly Average

Activity Continues About Normal—Energy Output Exceeds Last Year's by 13.1 per Cent—Revenue Up 12.3 per Cent

CONTINUING the rapid extension in the amount of energy generated this year as compared with the corresponding months of 1925, the August output shows a growth of 13.1 per cent, which happens to be exactly the same as the rate for the first six months of the year and slightly exceeds the figure for July. In the matter of revenue, likewise, the August gain of 12.3 per cent is substantially equal to the half-year average as given in the ELECTRICAL WORLD of Sept. 4, namely, 12.6 per cent.

As a current indicator of industrial activity the energy output is of more significance than the revenue, since the energy consumption is instantly responsive to any curtailment of production, whereas there is a time

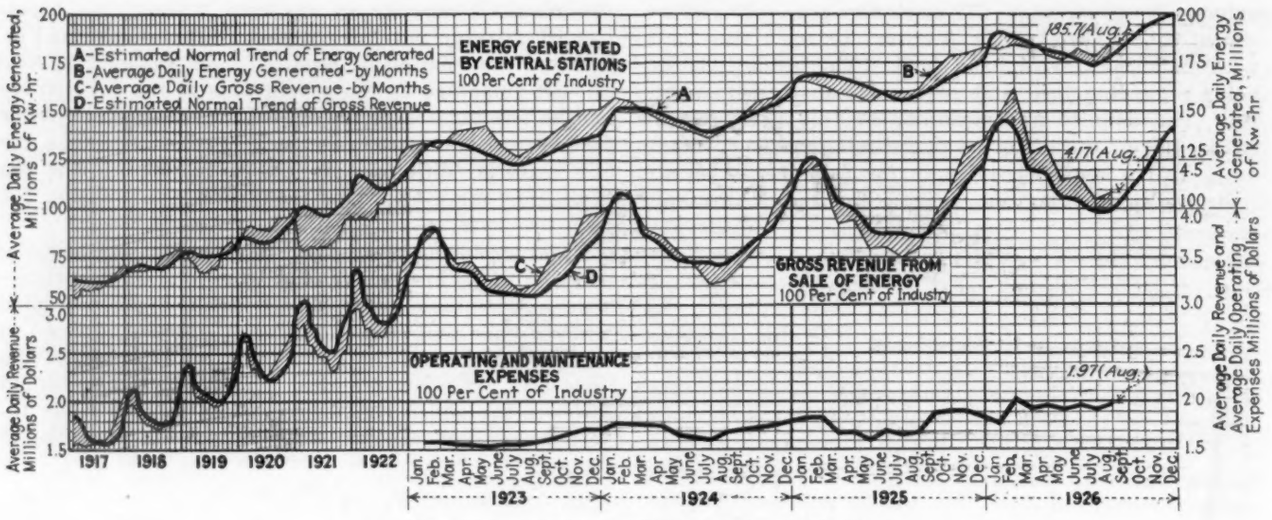
TABLE I—OPERATING RATIO OF CENTRAL-STATION COMPANIES

Month	Operating Ratio					
	Steam Plants		Hydro Plants		Combined Hydro and Steam Plants	
	1926	1925	1926	1925	1926	1925
May.....	48.8	49.7	30.8	33.1	41.7	38.5
June.....	50.0	51.5	30.4	31.7	43.5	43.8
July.....	51.6	53.6	34.1	32.5	44.9	45.8
August.....	51.8	51.1	38.7	36.0	44.8	45.3

TABLE II—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly *			Estimated Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale, Kw.-Hr.	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr.			
	1926 Thousands	1925 Thousands	Per Cent Inc.	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands
May.....	5,436,704	4,812,865	+12.9	4,386,704	3,883,865	1,164,000	1,089,000	2,662,704	2,255,865	560,000	539,000	1,050,000	929,000	1,081,000	735,000
June.....	5,509,356	4,829,035	+14.1	4,446,356	3,896,035	1,152,000	1,067,000	2,752,356	2,306,035	542,000	523,000	1,063,000	933,000	1,091,000	697,000
July.....	5,559,120	4,966,266	+11.9	4,486,120	4,009,266	1,164,000	1,079,000	2,758,120	2,384,266	564,000	546,000	1,073,000	957,000	1,008,000	738,000
August...	5,752,730	5,085,379	+13.1	4,642,730	4,102,379	1,212,000	1,123,000	2,866,730	2,433,379	564,000	546,000	1,110,000	983,000	1,138,000	773,000

*Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only


A-Estimated Normal Trend of Energy Generated
B-Average Daily Energy Generated-by Months
C-Average Daily Gross Revenue-by Months
D-Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
185.7(Aug.)
117(Aug.)
1.97(Aug.)
Average Daily Energy Generated, Millions of Kw-hr
Average Daily Revenue, Millions of Dollars
Average Daily Energy Generated, Millions of Kw-hr
Average Daily Revenue and Average Daily Operating Expenses Millions of Dollars
1917 1918 1919 1920 1921 1922
1923 1924 1925 1926

AUGUST OPERATIONS 5 PER CENT ABOVE NORMAL

lag between the generation and the receipt of payment for it.

To point out that revenue is 5.3 per cent in excess of the estimated normal for the month and that energy generated is 4.9 above normal is really to understate the activity, because the normal is itself affected by a peculiar condition. Being based on the average rate of growth during the preceding five years, it happens at the present time to cover a period that begins with the depression of 1921 and ends with the high activity of the year 1925. It would appear that the rate of growth established even by that standard is being exceeded.

Compared with July, generated energy, revenue and operating expenses have all increased slightly. This is in accord with the usual seasonal trend.

The striking increase from year to year in sales of energy for resale, to which attention has been called on several occasions, continues unabated. This month the gain is 47 per cent, and the quantity involved is a fifth of all the energy generated. While the nature of the item is such that a certain amount of duplication is almost inevitable, in that energy may be and at times is passed on more than once, it is evident that interconnections are playing a larger and larger rôle in the economics of power production and distribution.

The increase, about two-thirds of a billion kilowatt-hours, in energy generated over that of August, 1925, was almost equally divided between water and fuel power, but since the total of the former is only half as great as the latter the percentage gains were 19.0 for hydro and 10.1 for fuel power.

For the first time in many months the consumption of fuel oil is larger, though only slightly, than it was a year before, the combined result of a decrease in 1925 and an increase in 1926 as compared with July consumption. Gas has again increased, this time by 10.7 per cent.

TABLE III—CENTRAL-STATION FINANCIAL OPERATIONS FOR FOUR MONTHS IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Total Gross Revenue from Sale of Energy†			Estimated Distribution of Gross Revenue								Total Operating and Maintenance Expenses‡	
				Lighting Customers		Power Customers		Electric Railways		Other Public Utilities			
	1926 Thousands	1925 Thousands	Per Cent Inc.	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands	1926 Thousands	1925 Thousands
May	$131,600	$117,400	12.1	$84,300	$78,500	$33,500	$28,300	$4,700	$4,500	$9,100	$6,100	$58,900	$53,700
June	129,700	114,300	13.4	82,100	75,800	34,100	28,500	4,500	4,300	9,000	5,700	59,350	55,300
July	127,100	112,200	13.3	81,100	73,700	33,300	28,300	4,500	4,300	8,200	5,900	59,750	54,300
August	129,200	115,000	12.3	82,000	76,000	33,800	28,600	4,400	4,300	9,000	6,100	61,100	54,750

†Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡Do not include interest, taxes, depreciation or sinking fund.

TABLE IV—OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL PLANTS IN THE UNITED STATES*
(100 per Cent of the Industry)

Month	Energy Generated						Fuel Consumption								
	Hydro-Plants			Fuel Power Plants			Coal			Oil			Gas		
	1926 Thousands of Kw.-Hr.	1925 Thousands of Kw.-Hr.	Per Cent Increase	1926 Thousands of Kw.-Hr.	1925 Thousands of Kw.-Hr.	Per Cent Increase	1926 Short Tons	1925 Short Tons	Per Cent Increase	1926 Barrels	1925 Barrels	Per Cent Increase	1926 Thousands of Cubic Feet	1925 Thousands of Cubic Feet	Per Cent Increase
May	2,266,505	1,992,231	+13.6	3,170,401	2,820,634	+12.4	2,720,082	2,579,798	+5.5	569,125	639,763	—11.1	3,712,226	3,434,604	+ 8.1
June	2,191,225	1,810,908	+21.0	3,318,131	3,018,127	+ 9.9	2,807,988	2,704,974	+3.7	589,567	755,692	—21.9	4,190,576	3,667,081	+14.7
July	1,967,337	1,835,021	+ 7.2	3,591,783	3,131,245	+14.7	2,998,350	2,771,100	+8.2	669,014	814,718	—17.9	4,872,151	4,180,741	+16.6
August	2,064,586	1,735,369	+19.0	3,688,144	3,350,010	+10.1	3,064,690	2,975,728	+2.9	722,645	720,310	+ 0.3	5,314,505	4,801,130	+10.7

*As collected by United States Geological Survey. The data are for the electric light and power industry only.

Letters from Our Readers

International Problems of the Electrical Industry

To the Editor of the ELECTRICAL WORLD:

The last two days of the International Power Conference at Basle, Switzerland, were devoted to (1) the economical relation between electrical energy produced from water power and energy from coal, (2) the conditions under which a combination of the two systems is of advantage, and (3) the exchange of electrical energy between different countries.

The latest endeavors in the electrical industry have been directed toward a closer amalgamation of the districts of consumption with the sources of production, in order to obtain, in the first instance, more favorable results through a better distribution of consumers in relation to the producers of energy, and on the other hand to make use of every source of power to its utmost capacity according to its respective equipment. Both endeavors will ultimately lead to a reduction in the cost of electrical energy, which will benefit the consumers.

The extension of water-power plants necessitates considerable initial cost, varying at every individual plant, though in any case it would exceed the cost of the steam-power plant. However, the charges for the maintenance of water-power plants are dependent almost entirely only on the amounts needed for interest, depreciation and amortization of capital invested, whereas in the case of steam plants the expenses for fuel must be added to those just mentioned, and these in countries with no coal production of their own may assume very high proportions. Such countries have therefore given their attention in the main to the extension of existing water-power plants. Other countries, where it is possible to produce both kinds of electrical energy, have more and more made use of water power, trying at the same time to combine the two methods in such a way as to insure their economic operation.

It was pointed out that countries which still dispose of unused water power should not hesitate to proceed with the erection of the necessary plants, because they will always be able to compete with the steam-power plants under the conditions imposed by the present state of technical equipment, even if further progress should be made in the utilization of fuel. Here may be mentioned the endeavors made to produce chemical products and electrical energy at the same time.

The advantages which can be obtained in one country through a connection of various power plants to a mutual transmission line may also be had by neighboring countries through an exchange of electrical energy. International exchange of energy is only in the first stages of development. It exists at present between Switzerland on the one side and Germany, France and Italy on the other side, between Sweden and Denmark, and between Canada and the United States. The exchange of electrical energy therefore takes place between countries with a superfluity of water power and those where the generation of energy with expensive fuel is necessary.

Switzerland, for instance, is a country which exports electrical energy, and she sold abroad during the year 1925 about 650,000,000 kw.-hr., equaling about 13 per cent of her total production. Denmark has imported electrical energy from Sweden since the year 1914, this energy being supplied by means of a submarine cable. Twenty-five Swedish and Danish power stations, with a total capacity of 150,000 kw., are combining their production of energy for transmission over a common line. An exchange of electrical energy between Switzerland and Germany is regulated in such a way that Switzerland supplies its excess of power during the summer, enabling Germany to save considerable quantities of coal, whereas the latter country in return is providing Switzerland with electrical energy in winter, when there is less water power available. A similar exchange of power is planned between German and French electrical power plants in the Moselle district, on the one side, and Switzerland, on the other side.

It is thus demonstrated that the ability to exchange electrical power between different countries is undoubtedly of advantage and should be developed by every possible means.

LAWRENCE H. BAUER.

Berlin-Halensee, Germany.

Idle and Invested Human Capital

To the Editor of the ELECTRICAL WORLD:

Groundmen attached to overhead crews are the future foremen. Within a few months after a man joins a company as a groundman it should be known whether he is a red flag or a sticker. From the day he receives the "O.K." of the employment department and the doctor he is either idle or invested capital. As idle capital he goes along from day to day, "just working." As invested capital his gray matter as well as his hands are systematically developed. He becomes profitably invested capital when he eliminates lost motion and co-ordinates his operations with those of others.

During travels in more than half of the states in the Union the writer has observed hundreds of gangs of various sizes while doing their work. A large percentage of the field work is performed extravagantly, considering what could be done if the grey matter had been properly trained from the day the possessors joined the company.

Among reasons given for the promotion of linemen to foremen the following were found:

1. Lineman too heavy to climb any more.
2. Too old to climb with safety.
3. Met with an accident and incapacitated.
4. Stuck with the company during a strike.
5. Had a vacancy and had to promote some one.
6. Showed marked ability for management.

Job training—or, rather, the laying out of a campaign for training men all along the line from groundmen to foremen—cannot be efficiently handled without considerable special study. When scientifically and practically laid out, however, it can be carried on by any company. One company known to the writer has established a thorough field course for the men from the time they join the company through the various stages of advancement up to the finished foreman. As a result the company reports that the field work is performed with less fatigue at a saving of 20 per cent of the old-time requirements and that men are developing in the ranks capable of filling positions outside the field forces.

Progressive managements are beginning to realize that men must not be allowed to "drift up" to positions. Men must be "trained up."

RITCHIE GILL.

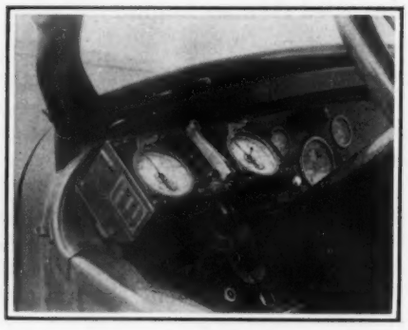
Evanston, Ill.

Central Station and Industrial Practice

Distance-Measuring Device for Extension Estimates

BY W. N. LINDBLAD
Assistant Chief Bureau of Tests and Inspections, Pacific Gas & Electric Company, San Francisco, Cal.

IN MAKING estimates for pole line or other extensions it is customary for a man to pace off the distance. This method, in addition to being inaccurate, requires considerable time, as it is necessary for a man to traverse the distance twice in order to return to his automobile.



INSTRUMENT THAT MEASURES POLE SPACINGS ACCURATELY AT SPEEDS UP TO FIFTEEN MILES PER HOUR

Inclement weather increases the difficulty and inaccuracy, as a man does not maintain his normal stride on muddy, slippery ground.

To overcome these objections a device called a "Duodometer"* was designed by the writer to be attached to an automobile for recording distances without it becoming necessary for the operator to stop or leave the machine. The apparatus, shown in the accompanying illustrations, consists of a metal box 4x10x2 in., which is placed on the dashboard of the automobile and connected to a speedometer gear on the front wheel by means of a standard flexible drive. The number of teeth in this gear is determined by the size of the tire used.

Motion is transmitted to a simple mechanical gear shift, which operates the pointers of either of two dials. The dials are graduated into 100 divisions, each division representing 1 ft. Each dial has two pointers or hands, one black and one red, which are concentrically operated similarly to the hands of a clock. The longer hand makes one revolution for 100 ft. and the shorter hand one revolution for 1,000 ft. A reset device on each dial returns the hands to zero instantly. The gear shift has three positions—right, left and neutral. When the Duodometer is not in use, it is left in the neutral position.

The operation is as follows: With the gear shift in neutral and both dials set at zero, the automobile is driven past the first pole at a speed of from five to fifteen miles an hour. As the pole comes abreast of the driver the gear shift is pushed to one side or the other, causing the hands on one dial to revolve. As the succeeding pole comes abreast, the gear shift is pushed to the opposite side, engaging dial No. 2 and disengaging and stopping dial No. 1 instantly by means of a brake. Dial No. 1 is now read and returned to zero and the operation repeated at the next pole with dial No. 2. A record is thus obtained of the spacing of any number of successive poles with remarkable speed and accuracy.

By accurately measuring several pole distances near the garage where the car is kept it is possible to check the device as often as desired. A number of these instruments have been in continuous use for laying out pole-line, underground-cable and gas-line extensions for more than three years with very little maintenance.

*Patented.

One of the Highest Water Chutes in the World

THE electric power plants met with in Switzerland present the combination of small volume and maximum force, and the power thus obtained from each unit of water is consequently very high. The Swiss power plant at Fully, in the Canton of Valais, holds the world's record among piped water chutes. Its fall is figured to be 5,460 ft. Its reservoir is formed by the little lake of Fully, situated far up on the Dents de Morcles mountains that bar the way of the Rhone and make it take a sharp turn at their feet before it can flow into Lake Léman. A dam has raised the waters of this lake to 2,139 ft. above sea level at present, but its maximum height is calculated at 7,070 ft. The amount of water in the reservoir is about 3,200,000 cubic meters.

Transforming the lake into a reservoir was an interesting operation. A deep pit was dug near the shore of the lake. From the bottom of this pit a gallery was pierced, which was intended primarily to penetrate the solid rock below the lake to a point where the lake bottom was to be opened, liberating the water, which was then to escape through a conduit placed at the bottom of the pit. Unfortunately the soundings, although they had been made with great care before the

THE SWISS POWER PLANT AT FULLY, IN THE CANTON OF VALAIS, UNIQUE AMONG PIPED WATER CHUTE INSTALLATIONS

FULLY LAKE, WHICH FORMS A RESERVOIR FOR THE WATER SUPPLY TO THE SWISS POWER STATION, LOCATED NEARLY A MILE BELOW

work was begun, did not correctly place the location of the rock bottom of the lake and the tunnel very shortly arrived at a layer of soft limestone, which put a stop to the work along that line. This first gallery was therefore stopped up with a wall of masonry and abandoned, and another pit was dug farther back. The gallery leading from this second pit successfully reached the rocky bottom of the lake. When everything was ready to receive the water, the thin wall left at the head of the tunnel was destroyed by a final mine set off electrically, and the water rushed down the conduit.

This conduit, 15,225 ft. long, runs through tunnels or covered trenches on account of the danger of avalanches or the changes of temperature to which it would be exposed if it lay free. The turbine house is situated at a height of 1,630 ft., which gives the pipe line its remarkable fall of 5,460 ft.

One liter of this water collected in the Fully reservoir after its fall of more than a mile strikes the turbines a 16-hp. blow. The turbines thereupon send on 75 per cent of this power, which the generator transforms into 10 kw. of electrical energy. A constant volume of 1 liter a second for one year—that is, 31,536 cubic meters—would represent 100,000 kw. Every square meter, therefore, in the Fully reservoir means 3.15 kw. of stored power. The water reaches the turbines through a small orifice 38 millimeters in diameter at the rate of about 545 ft. a second, or 600 kilometers an hour, and with this fall of 5,400 ft. is enough to generate a force of 3,000 hp.

It seems that an honest dragoon, ignorant of the formidable strength of this slender rod of water, said he could easily cut it with his sabre and proceeded to try to do so. His steel blade was snapped in pieces by the water and his arm felt the unexpected jerk for weeks afterward.

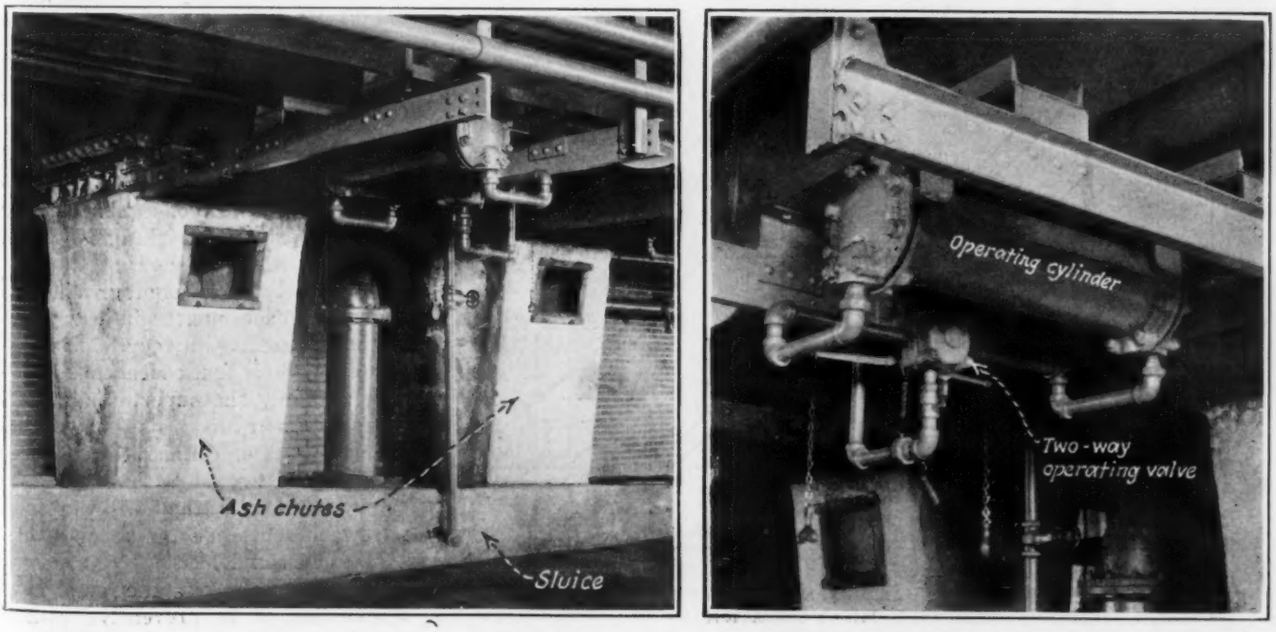
Every liter of water having such an amount of stored-up energy, the company has now installed a pumping station to draw the water from the Lake of Sorniot, 478 ft. lower down, into the Fully reservoir. The pumping system is so arranged that the water can be forced directly into the main pipe line, or up into the reservoir, or partly into the line and partly into the reservoir.

The conduit is 1.98 ft. in diameter at its highest point and 1.65 ft. at its lowest. Its thickness varies from 0.236 in. to 1.62 in. The lengths of the pipe are tightly cemented above, whereas below they are laid without cement. The fact that the line is covered all the way down has done away with the need for expansion joints.

The power house is equipped with four Pelton turbines coupled to alternators fixed to a common axle. These turbines furnish 2,800 amp. at 10,000 volts and make 500 r.p.m.

Hydraulically Operated Ash Gates

AT THE Valmont steam plant of the Public Service Company of Colorado, where pulverized coal is burned, hydraulically operated ash gates are used. The gates are actuated by water under pressure admitted to one end or the other of the cylinder through a two-way operating valve. The operation requires practically no effort, and the gates will not creep. When the gates are opened, the ashes drop through tapered chutes into a concrete ash sluice and are carried out of the plant.



ARRANGEMENT OF HYDRAULICALLY CONTROLLED ASH GATES AT VALMONT STATION OF PUBLIC SERVICE COMPANY OF COLORADO

Steam Rates at Different Vacua Assist Operators

BY J. R. DOWDELL

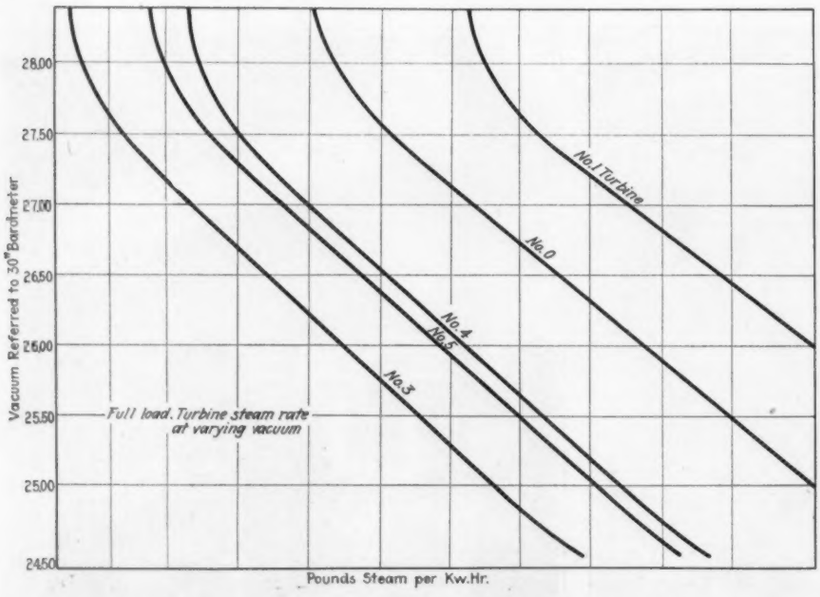
Assistant Engineer Houston Lighting & Power Company, Houston, Tex., Gable Street Station

TO MAINTAIN the highest operating efficiency of its turbines, the Houston Lighting & Power Company provides its operators with a chart showing the turbine steam rates at different condenser vacua for each turbine likely to be obtained under operating conditions. With this information the most economical unit or units available can be kept in service and consequently the greatest energy output can be generated with the least amount of steam consumption.

The form of the chart provided is indicated in the accompanying illustration. It is made up from performance tests conducted by the manufacturers. With the particular machines to which this chart refers, higher efficiencies are obviously obtained at higher vacua than 28 in., but the increases are very small, as our circulating water seldom is low enough in temperature for vacua more than 28 in., so that the operator can approximate the performances at higher vacua.

The vertical scale is plotted in "Vacuum referred to a 30-in. barometer," this value being obtained by the operator by subtracting the amount by which the barometer reading exceeds 30 in. from the vacuum gage reading on the condenser, or adding the amount by which the barometer is less than 30 in. to the observed vacuum. The horizontal scale is plotted in terms of pounds of steam per kilowatt-hour.

All of the curves are based on full-load conditions on the turbines and will vary for other loads according to the turbine characteristics.



FORM IN WHICH DATA ARE GIVEN OPERATORS TO ENABLE MORE ECONOMICAL OPERATION

Transportation Efficiency

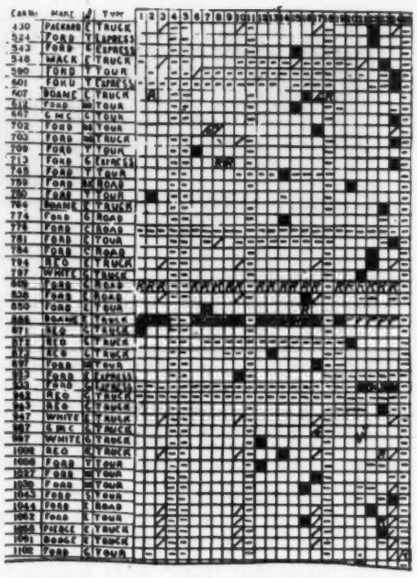
BY JAMES V. MURRAY

AN EFFICIENCY scheme used by the Pacific Gas & Electric Company of San Francisco in keeping track of all of its automotive units, consisting of 100 Fords and 100 Dodge delivery trucks, as well as 100 other vehicles up to its 5-ton trucks, consists of great wall blackboards, maintained in each of the two big garages of the company.

The use of these enables not only the superintendent of transportation, Edwin C. Wood, and his assistants, but all department heads as well, to know the percentage of efficiency earned by each piece of equipment during the month.

"Using the unit truck system and the unit replacement of parts system and specializing the men are a few of the factors that enable us to hold onto a 97 per cent load factor in operation most of the time," said Mr. Wood.

"The control boards in each garage give us the number of days a car is tied up for repairs in the shop, how many days it remains in the paint shop, its days in service, the number of days idle not due to shop necessity and the day it was serviced on general lubrication throughout. The latter information is indicated by the apprentice on the blackboard by a white square alongside the right vehicle and under the right day of the month. Other marks used are 'R' for ordinary repairs needed, 'A' for repairs needed due to accident, 'P' when the car is in the paint shop on that particular date and 'OH' for a complete overhaul in progress.



A PORTION OF SERVICE CONTROL CHART

A line diagonally across a particular square means that the car has been one-half day in service. A blank means 'car in service,' and, of course, the ideal situation is to have as many blanks on the boards as possible. Idle days, not due to our fault, are shown by a short horizontal line dividing the square in two.

"Before we installed this system there were an inordinate number of these 'idle days,' caused by heads of departments not being informed of the availability of their equipment, with the consequence they were not prompt in taking it out of our shops when finished.

"As the board is photographed at the end of each month and every one concerned receives a copy of the picture, the whole truck situation is before not only the superintendent of transportation in this office but everybody else. Since the department heads are as strong for efficiency as we are, they will pick out any weak spots in their departments at a glance and hasten to have any such corrected. As the plan now works out, it is preventive rather

than telltale, and is well regarded by everybody.

"We endeavor to keep ahead of our motor vehicles instead of following around after them and trying to save the pieces after the damage has been done, and we feel that these features earn their trouble and expense. The work on the big blackboards, for instance, costs us only $30 a month, and by using it we are achieving a 97 per cent load value on a fleet of 100 Fords, an equal number of Dodges and a large investment in other automotive equipment."

Co-operative Effort Receives Unanimous Support

THEORETICALLY, co-operative effort has always been considered a sound basis for mutual success, but some persons still remain dubious regarding its practical working despite many successful instances. Just another example is afforded by the recent unanimously supported resolution of the Electric League of Beaver Valley, New Brighton, Pa. It is particularly interesting in that special emphasis was placed on the co-operation given dealers by the Duquesne Light Company. The resolution follows:

"Whereas the Electric League of Beaver Valley, recently organized for the common interests of persons identified with the electrical industry in this community, recognizing friendly counsel and advice, and

"Whereas the Electric League of Beaver Valley in the completion of a successful range campaign has learned the value of co-ordinated efforts and has expressed its confidence in the sound foundation laid for future results, and

"Whereas the recognition given not only to the league but to the individual dealers by the Duquesne Light Company has created a feeling of friendliness and higher regard of co-operation; therefore,

"*Be It Resolved*, That the Electric League of Beaver Valley express its appreciation to the executives and employees of the Duquesne Light Company, of the Landers, Frary & Clark Company, Westinghouse Electric & Manufacturing Company, Iron City Electric Company and the Robbins Electric Company, which so ably assisted it in the formation, financing and completion of this campaign, by giving untiringly of their time to add prestige to this, the first campaign of our league."

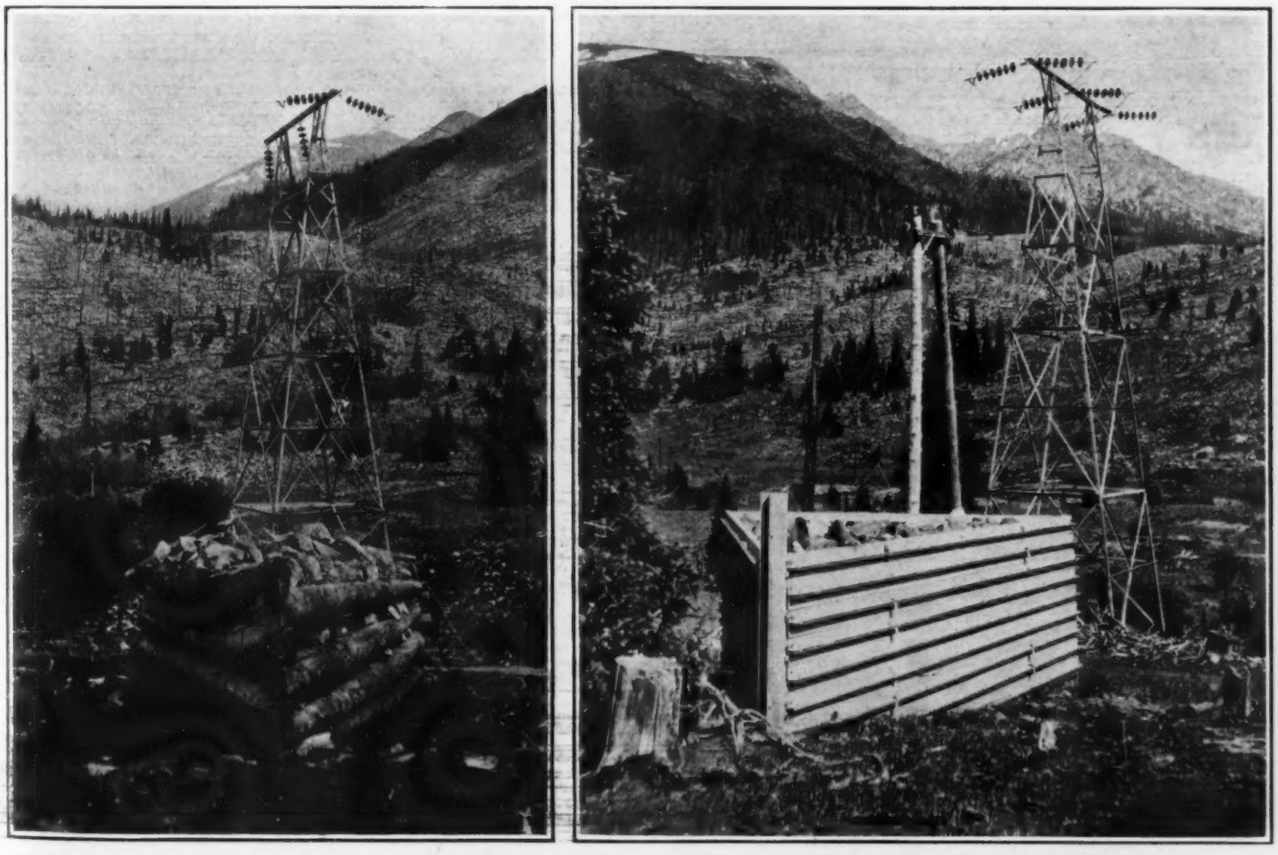
Responding to this resolution, M. E. Skinner, commercial manager of the Duquesne Light Company, said in part:

"I think league co-operation has proved to us beyond the question of a doubt the merit of getting together and pulling as a unit in matters that have to do with the electrical industry, and I know that in the future we shall have other plans to suggest that will be along the lines of the range campaign just completed."

Snow Slide Deflectors Protect Towers

MAINTAINING a 110-kv. transmission line over the Rocky Mountains in Colorado during the winter presents many difficulties, not the least of which are snow slides. The Shoshone line of the Public Service Company of Colorado crosses the Continental Divide several times at elevations in excess of 10,000 ft., and considerable trouble has been experienced with snow slides at the higher altitudes. If the snow is not deflected in some manner, the towers may be badly damaged or even swept down.

A satisfactory and effective means of deflecting the snow has been to install deflectors of the type shown in the accompanying illustrations. Two types are in use; one is a log crib filled with rocks and the other is made of angle irons and is also filled with rocks. These devices have been in satisfactory use for several years and continue to serve their purpose admirably.



TYPES OF SNOW BREAKERS USED TO PREVENT DAMAGE TO TRANSMISSION TOWERS IN THE ROCKY MOUNTAINS

Commercial Activities and Public Relations

Linemen to Get Tree-Trimming Lessons

IT HAS been realized for some time that damage to shade trees by employees of public utilities is a ready cause for ill feeling on the part of the public. It is said that consumers who will put up with minor inconveniences inherent in public utility operations will become downright irate at the spectacle of an electrician mutilating trees that have required years of nurture. Recognizing, however, that the use of overhead transmission lines frequently necessitates a certain amount of tree pruning, the Empire State Gas and Electric Association thought that utility employees should receive instructions in approved methods for this work.

Through efforts of the association the New York State College of Forestry of Syracuse University is to offer a course of instruction in tree trimming to linemen of the public utility companies.

Although the course of instruction has been planned primarily for linemen of electric utilities, other individuals are at liberty to take it. Lectures and discussions will be supplemented by field trips for study of actual conditions and demonstrations in tree pruning. In addition, it is said the course will include a study of tree growth, diseases, repairs, planting and moving of trees, sprays and other phases of tree culture.

Utility Contracts for Appliance Sales

San Joaquin Light & Power Corporation Pays Stipulated Sum per Kilowatt for Load Added—Plan Has Many Advantages

WHAT can be accomplished by a merchandising department operated as a separate entity but in conjunction with a central station is shown by sales records of the Valley Electrical Supply Company during the first six months of 1926. This company is a subsidiary of the San Joaquin Light & Power Corporation, operating in the San Joaquin Valley of California, and is under the direction of H. H. Courtright, president and manager.

Late in 1925 the San Joaquin Light & Power Corporation entered into a contract with the Valley Electrical Supply Company to distribute a certain number of energy-consuming appliances over the system of the utility company, which has approximately 53,000 domestic customers. Under this arrangement the Valley Electrical Supply Company was to receive a stipulated sum for each kilowatt of appliance load added to the lines of the San Joaquin Light

COMPARISON OF ESTIMATED AND ACTUAL SALES OF LAMP-SOCKET APPLIANCES FOR THE FIRST SIX MONTHS OF THE YEAR 1926

Items	Sales			Kw. Put on Lines			Estimated Yearly Revenue			Sales Cost		
	Estimated	Actual	Over *Under*	Estimated	Actual	Over *Under*	On Quota	On Sales	Over *Under*	Estimated	Actual	Over *Under*
Cookers	2,050	2,558	508	820.00	1,024.50	204.50	$8,200.00	$10,245.00	$2,045.00	$3,001.20	$3,749.67	$748.47
Toasters	1,070	929	*141*	588.50	510.95	*77.55*	5,885.00	5,109.50	*775.50*	2,153.91	1,870.08	*283.83*
Air heaters	125	90	*35*	75.00	66.44	*8.56*	750.00	664.40	*85.60*	274.50	243.17	*31.33*
Waffle irons	1,080	1,602	522	712.80	1,051.3	388.53	7,128.00	10,513.30	3,385.30	2,608.85	3,847.85	1,239.00
Flatirons	425	686	261	255.00	394.65	139.65	2,550.00	3,946.50	1,396.50	933.30	1,444.42	511.12
Fans	500	590	90	30.00	38.28	8.28	300.00	382.80	82.80	109.80	140.10	30.30
Table stoves	250	105	*145*	165.00	63.00	*102.00*	1,650.00	630.00	*1,020.00*	603.90	230.58	*373.32*
Heat pads	30	63	*33*	1.80	3.78	1.98	18.00	37.80	19.80	6.59	13.83	7.24
Vacuum sweepers	170	176	6	25.50	26.40	.90	255.00	264.00	9.00	93.33	96.62	3.29
Soldering irons	60	24	*36*	12.00	4.80	*7.20*	120.00	48.00	*72.00*	43.92	17.57	*26.35*
Battery chargers	.....	22	22	.....	2.20	2.20	.....	22.00	22.00	.....	8.05	8.05
Percolators	1,150	1,060	*90*	460.00	444.08	*15.92*	4,600.00	4,440.80	*159.20*	1,683.60	1,625.33	*58.27*
Miscellaneous	340	530	190	47.60	74.34	26.74	476.00	743.40	267.40	174.22	272.08	97.86
Totals	7,250	8,435	1,185	3,193.20	3,704.80	511.60	$31,932.00	$37,048.00	$5,116.00	$11,687.12	$13,559.35	$1,872.23

Six months sales of lamp socket appliances	3,704.8 kw.	Yearly revenue on lamp socket appliances sold these six months	$37,048.00
Six months quota of lamp socket appliances	3,193.2 kw.	Sales cost to power company	13,559.57
Sold over quota	511.6 kw.	or, 36.6 per cent of one year's revenue.	
Six months estimated revenue on sales	$37,048.00		
Six months estimated revenue on quota	31,932.00	Five years' revenue on above appliances	$185,540.00
Estimated revenue over quota	$5,116.00	Sales cost to power company	13,559.57
Estimated kilowatt quota for twelve months	8500.00	or, 7.32 per cent of five years' revenue.	
Estimated yearly revenue on this quota	$85,000.00		

LAMP-SOCKET APPLIANCES—USE AND EARNINGS

Appliance	Rated Wattage	Hours per Year Use	Kw.-Hr. per Year Use	Rate Per Kw.-Hr.	Annual Rev. per Appliance	Annual Revenue per Kw.	Number of Appliances to Be Sold in 1926	Total Kw. to Be Sold in 1926	Annual Revenue from 1926 Sales
Cookers	400	364	145.6	$.07	$10.19	$25.47	6,000	2,400	$61,140
Air heaters	600	360	216.0	.07	15.12	25.20	3,000	1,800	45,360
Toasters	550	104	57.2	.07	4.00	7.27	2,500	1,375	10,000
Waffle irons	660	104	68.6	.07	4.80	7.27	1,500	990	7,200
Flat irons	600	156	93.6	.07	6.55	10.92	1,400	840	9,170
Fans	60	450	27.0	.05	1.35	22.50	1,200	72	1,620
Table stoves	660	91	60.1	.07	4.21	6.38	500	330	2,105
Vacuum cleaners	200	104	20.8	.07	1.46	7.30	400	80	584
Soldering irons	250	624	156.0	.04	6.24	24.96	300	75	1,872
Battery chargers	100	1,560	156.0	.07	10.92	109.20	200	20	2,184
Percolators	420	120	50.4	.07	3.53	8.40	2,500	1,050	8,825
								9,032	150,060

Average revenue per kilowatt on above basis. $16.61 Average revenue per kilowatt on 1 cent lower rate. $14.14 Average used in estimating earnings..... $10.00

COMPARISON OF ESTIMATED AND ACTUAL SALES OF HEAVY-DUTY APPLIANCES FOR THE FIRST SIX MONTHS OF THE YEAR 1926

Items	Sales: Estimated	Sales: Actual	Sales: Under	Kw. Put on Lines: Estimated	Kw. Put on Lines: Actual	Kw. Put on Lines: Over	Estimated Yearly Revenue: On Quota	Estimated Yearly Revenue: On Sales	Estimated Yearly Revenue: Over	Sales Cost: Estimated	Sales Cost: Actual	Sales Cost: Over
Ranges	506	457	49	3,036	3,146.7	110.7	$48,576.00	$50,347.20	$1,771.20	$15,422.88	$15,985.24	$562.36
Water heaters	400	385	15	1,600	1,678.9	78.9	25,600.00	26,862.40	1,262.40	8,128.00	8,528.81	400.81
Air heaters	210	123	87	420	469.0	49.0	6,720.00	7,504.00	784.00	2,133.60	2,382.52	248.92
Other H.-D. appl.	150	136	14	300	555.8	255.8	4,800.00	8,892.80	4,092.80	1,524.00	2,823.46	1,299.46
Total	1,266	1,101	165	5,356	5,850.4	494.4	$85,696.00	$93,606.40	$7,910.40	$27,208.48	$29,720.03	$2,511.55

Six months sales of heavy-duty appliances..... 5,850.4 kw.
Six months quota of heavy-duty appliances..... 5,356.0 kw.

Sold over quota..... 494.4 kw.
Six months estimated revenue on sales..... $93,606.40
Six months estimated revenue on quota..... 85,696.00

Estimated revenue over quota..... $7,910.40
Estimated kw. quota for twelve months..... 10,800.00
Estimated revenue for twelve months on this quota..... $172,800.00

Estimated yearly revenue on heavy-duty appliances sold these six months..... $93,606.40
Sales cost to power company..... 29,720.03
or, 31.75 per cent of one year's revenue.
Estimated five years' revenue on heavy duty appliances sold these six months..... $468,032.00
Sales cost to power company..... 29,720.03
or, 6.35 per cent of five years' revenue.

& Power Corporation. The program included definite quotas for heavy-duty appliances, lamp-socket appliances and home lighting, and included the establishment of a new store at Bakersfield. Results under this arrangement during the first six months of 1926 are shown in the accompanying tables.

Compared with the first six months of 1925, sales for the same period of 1926 showed a gain in connected load of heavy-duty appliances sold of 35.6 per cent, and on lamp-socket appliances the increase was 146 per cent.

The arrangement between the Valley Electrical Supply Company and the San Joaquin Light & Power Corporation has many advantages, a few of which are:

Possibility of determining at any time the exact cost of merchandising activities.

Relieves the power company of all responsibility for appliance selling, stocks, warehousing, etc.

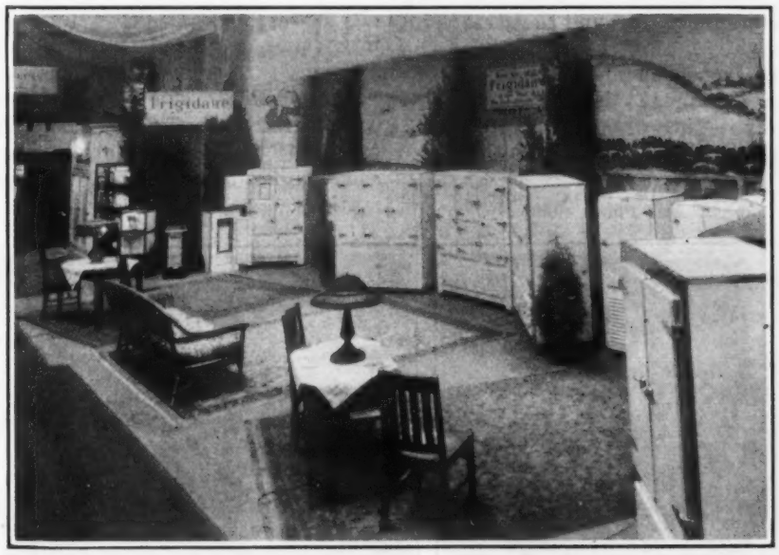
Definitely places the responsibility of appliance merchandising on an organization which for its self-preservation must show results.

Responsibility for good or bad public relations resulting from appliance selling is definitely placed on one man.

Relieves the central station from any bad public relations resulting from unfavorable credit relations with purchasers.

Removes from the utility accounting department much accounting procedure foreign to the ordinary conduct of public utility business.

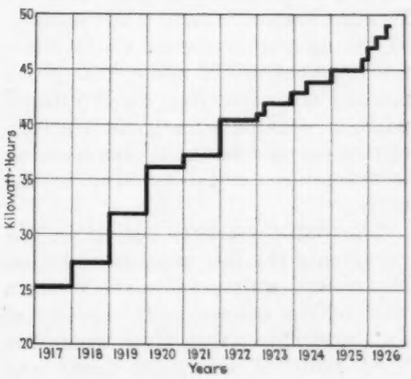
Refrigeration Show Draws 5,500 Visitors in Week



SALES of electric refrigerating units were markedly stimulated during early October at Boston as a result of the second annual show under the auspices of the Boston Edison Company and ten leading manufacturers' agents, held Sept. 27 to Oct. 2 in Horticultural Hall. The total expense was about $5,000. According to C. Ernest Greenwood, chairman of the show committee, it is estimated that at least 200 sales made between the time the show began and Oct. 15 are directly attributable to the display. The Edison company financed 40 per cent of the cost and the manufacturers carried the balance on a prorated space basis. The Edison company sold more refrigeration machines during the first week of October than in all October, 1925, or in the six weeks previous to Sept. 15, 1926. Although 80,000 complimentary tickets were mailed to prospects, no less than 550 persons paid 50 cents each to enter the show. About 5,500 visitors attended in six days.

Residential Consumption Increased 85 per Cent

THE combined effect of an attractive rate for residential service backed up by an aggressive sales department may be readily seen in the accompanying graph, showing the average monthly kilowatt-hours consumed per residence customer of the Northern Ohio Power & Light Company from 1917 to August, 1926. For the entire period the per-customer use of energy has increased 85 per cent while the revenue per



RESIDENTIAL ENERGY CONSUMPTION PER MONTH, TWELVE MONTHS' AVERAGE

customer has increased 72 per cent. Much of these increases are attributed by M. W. Arthur, manager of sales and distribution, to the fact that the company has incorporated in its rate a low block to encourage the freer use of appliances. This has been followed up with consistent merchandising effort.

Commenting upon the increased consumption and revenue Mr. Arthur says: "Prior to 1923 we did not

differentiate between city, suburban and rural service, but at the beginning of that year we established extra charges for this more expensive service. All of our residence customers being included in the averages shown therefore accounts for the great increase indicated.

"Our present residence rates are of the 'block meter' type and all provide for a charge of 3 cents per kilowatt-hour for all over 60 kw.-hr. used per month, whether the energy be used for lighting, cooking, refrigeration or any other domestic purpose, except power.

"We are naturally quite proud of this growth of 85 per cent in the per-customer energy consumption during the last eight years. We attribute this growth to our active merchandising policy, the promotion of cooking and refrigeration and the use of a rate that encourages the full use of our service."

Utility Equipment for Locating Radio Interference

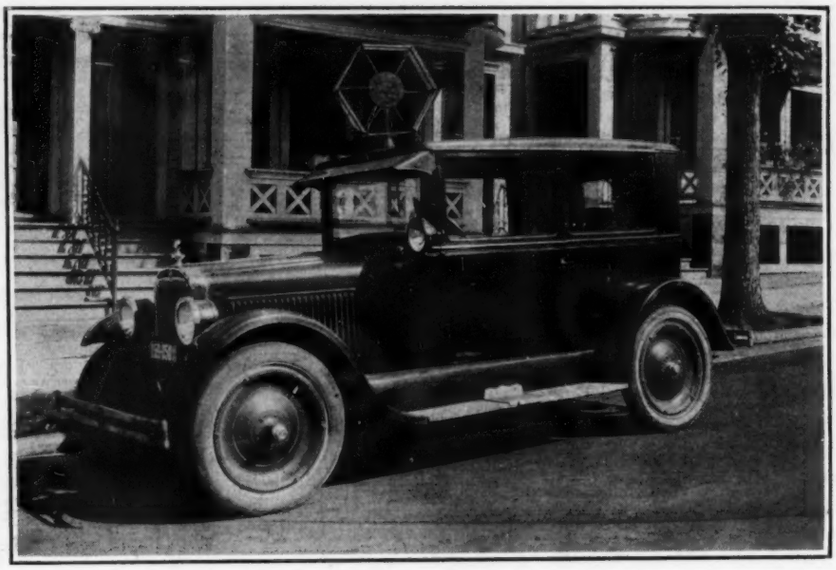
RADIO interference, because of its public relations angle, has received the attention of many utility executives during the past year or more, so that practically every electric utility is now doing something in the interest of radio-broadcast listeners. The Portland (Ore.) Electric Power Company saw the advisability of taking cognizance of radio interference complaints about two years ago and since that time has developed what it considers very satisfactory equipment and methods for locating interference caused by electric circuits.

The outfit recently placed in use represents the last word in radio interference equipment in the western part of the country. It consists of an automobile coach, from which has been removed the right front and rear seats. Next to the driver's seat is a super-heterodyne receiver, which is cushioned to prevent microphonic noises. The loop from which the receiver operates is on top of the car but is controlled from the driver's seat. In the rear is a cabinet which contains the batteries, a padded drawer for instruments and a drawer with a lid that serves as a desk. On top of the cabinet is a Western Electric cone speaker and a test panel connecting to batteries, loud speaker, receiving set, audibility meter, etc.

Trouble calls average about 50 per month. These come in through the service department and are turned over to the man* in charge of radio-interference work. Before going out on a complaint he first calls the customer and inquires regarding the nature of the trouble and asks if tubes, batteries, etc., have been checked. This serves two purposes: It reduces unnecessary investigations and enables the trouble man intelligently to go about finding interference causes. Many cases of interference can be found by simply driving the automobile around the streets, all the while noting the intensity of the interference on an audibility meter mounted on the receiving set. To eliminate interference from the automobile ignition system it has been necessary completely to shield all ignition wiring and the spark plugs. The set may be made super-sensitive or less sensitive by tuning or detuning the loop. It is possible also to remove the oscillator tube and use the set as a straight regenerative circuit. The outfit, exclusive of the automobile, cost about $500.

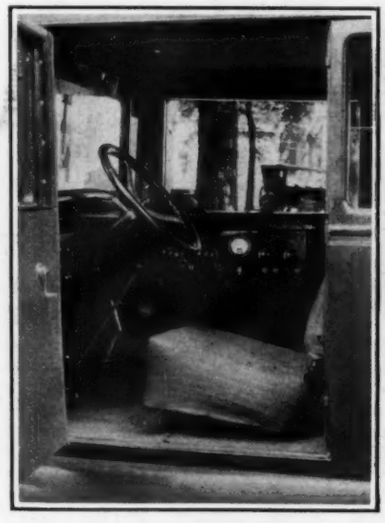
In some aggravated cases the source of interference has been located within a block by driving the automobile several miles out of the city away from any power lines that might pick up and carry interference and taking bearings with the loop.

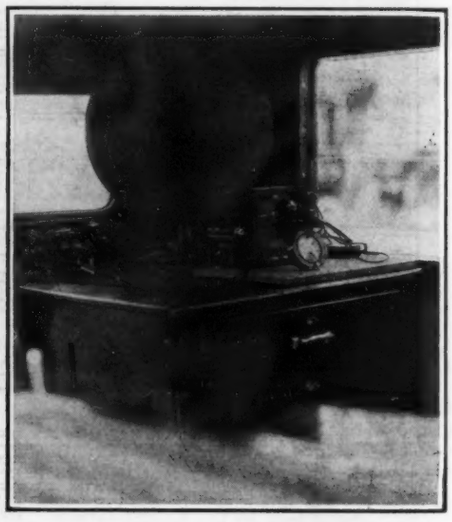
One prolific source of interference was cleared up early in the company's experience by placing choke coils in each magnetite-arc circuit at the substations.



AUTOMOBILE COACH FITTED FOR RADIO-INTERFERENCE STUDY

*W. R. Cornell, radio-interference engineer, is in charge of this work for the Portland Electric Power Company.





AT LEFT, A SUPERHETERODYNE RECEIVER MOUNTED NEXT TO THE DRIVER'S SEAT. AT RIGHT, CABINET IN REAR OF CAR FOR BATTERIES, INSTRUMENTS, TEST BOARD, AUDIBILITY METER AND LOUD SPEAKER

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Design of High-Pressure Industrial Power Plants.—R. S. BAYNTON.—The modern tendency toward the use of high steam pressures in utility-plant practice has its counterpart in the more conservative industrial power plants, and in industries such as those manufacturing pulp and paper, sugar, soap, artificial silk, etc., which use large quantities of steam for process work at various pressures. In the plant described in this paper the cost of electric power has been reduced 80 per cent, according to the author, the present cost in B.t.u. per kilowatt-hour being only half of that of a utility, this, of course, being due to the complete utilization of the exhaust steam in process work instead of the rejection of the major portion of the heat to the condensers. The electric and steam power are thus almost wholly obtained as a by-product and at consequently very high efficiency. It is the author's desire to point out that the design of an industrial power plant of the new style, though the plant may be comparatively diminutive from the standpoint of the utility, must be carefully studied so that it may exactly fit all the conditions.—*Mechanical Engineering*, October, 1926.

New Austrian Power Stations.—A symposium from which it is learned that the program for the general electrification of the Austrian Republic is being carried out with utmost expedition. Five major articles give descriptions of the latest hydro-electric power stations which have been added to the general electric power supply of Austria. Some of these plants furnish power for the railways, while others serve to meet a more or less local demand. All but one of the new stations are of the high-head type with Pelton wheels as prime movers. Each of the articles deals with one plant, and the tabulation gives their essential data.—*Elektrotechnik und Maschinenbau*, Sept. 26, 1926.

DATA ON FIVE NEW AUSTRIAN HYDRO-ELECTRIC PLANTS

Plant	Capacity, Hp. Now	Capacity, Hp. Ultimate	Head, Ft.
Achensewerk*..	54,700	108,000	1,250
Gampadelwerk..	9,000	13,500	1,200
Bärenwerk.....	10,500	.....	900
Kachletwerk*...	59,600	74,500	25
Gamingwerk*...	10,000	.....	630

* Unfinished.

Generation, Control, Switching and Protection

Fire Protection of Large Electric Machines. — F. LIEBSCHER. — Fires started in electric machines from short-circuit arcs almost always cause much greater damage than the arc itself. Various methods have therefore been suggested to quench such fires as quickly as possible by an injection of water, steam or gas. It seems, however, that while fighting the fire with water or steam is successful, the consequent damages to windings, etc., from the water are very considerable. The gas processes are therefore far superior, provided that a gas is used which is fully inert. The modern air-circulating system of cooling machines, where substantially the same air volume is used over and over again, is a strong argument for such gas quenching. The author undertook very elaborate electrochemical tests to determine the effect of a more or less diluted oxygen component of the air volume in the machine by substituting for it a corresponding amount of carbon dioxide. He found that if the oxygen content of air is diminished to 15 per cent, combustion can no longer be maintained. To reduce the oxygen component of 21 per cent to the desired 15 per cent one-third of the air volume has to be displaced by CO_2, and this has to be done as quickly and as completely as possible. To be of tangible value this displacement should be accomplished within a very few seconds. No method has proved more successful than an injection of liquid CO_2. The use of compressed carbon dioxide is not recommended, because it requires much room for the bombs and tends to freeze when quickly released. No detrimental after effects of any kind were noticed from generator fires put out by carbon dioxide.—*Siemens Zeitschrift*, September, 1926.

Transmission, Substations and Distribution

Notes on the Vibration of Transmission-Line Conductors.—THEODORE VARNEY.—This paper describes tests made with a graphic recorder to show the vibration of transmission-line conductors under various conditions of wind velocity, conductor tension and span length. The method of taking the records is discussed and formulas are given for determining the velocity of propagation of transverse waves along a conductor, the frequency of vibrations caused by "eddies" formed at a conductor subjected to air currents and, finally, the wave length of a vibration. —*Journal of A.I.E.E.*, October, 1926.

Bronze Wires for Power Lines.—R. EDLER.—While for main transmission lines copper, aluminum and steel-aluminum cables are the only type of conductors to be considered, it seems that short lines of secondary importance could readily be made from solid bronze wire. The economies and mechanical advantages of such lines are decidedly worth while. To aid the designer a great many data are tabulated from calculations by the author giving the comparative sags for copper and bronze wires. Three popular sizes of wire and five average spans at temperatures between + 40 and — 20 deg. C. are the basis for all tabulations. In addition, generally applicable mathematical formulas are given to compute these values for any desired conditions.—*Elektrotechnische Zeitschrift*, Sept. 2, and 9, 1926.

Units, Measurements and Instruments

Synchronous Machines—Extension of Blondel's Two-Reaction Theory.—R. E. DOHERTY and C. A. NICKLE.—As presented this paper is an abridgment of the authors' treatment of the subject. Using Blondel's idea of treating salient-pole machines by resolving the fundamental space component of mmf. along the two axes of symmetry — the direct axis of the pole and the quadrature axis between poles—and applying harmonic analysis, the theory has been extended by the authors in the present paper to a comprehensive system of treatment in which the effect of harmonic mmfs., as well as of the fundamental, and also of field mmf. in the quadrature axis as well as in the direct, have been taken into account. Subsequent papers in the near future are to present results which have been obtained from the application of the method and point of view here outlined to the solution of problems relating to abnormal operating conditions of synchronous machines. — *Journal of A.I.E.E.*, October, 1926.

Fault Localization on Cables.—N. A. ALLEN.—This is the last of a series of four articles which have appeared in the *Electrical Review* on the subject of a test which is applied to high-pressure cables after installation so as to insure that no damage has taken place during the process. Direct current at a high pressure has been adapted as a testing medium in accordance with modern practice. The convenience and utility of the two-valve kenotron apparatus for applying these tests has been demonstrated, and in addition there has been shown how a study of the behavior of the dielectric may be made during the testing period. The present article attempts to describe yet another feature of this type of testing outfit which gives it further advantage over other types of apparatus. New applications of the kenotron apparatus are presented in detail by the author. — *Electrical Review (England)*, Oct. 1, 1926.

Motors and Control

Sewing-Machine Motors.—A. BAYERLEIN.—By describing the three main types of modern sewing machines the author explains the particular operating requirements for the electric drive of such machines. To obtain best results the motor has to be specially designed for this service. A universal motor type is recommended and described which becomes suitable for either single-phase or direct current by a simple reconnection. While a manually operated machine may make up to 300 stitches per minute, foot-treadle drive will more than double this speed, and motor operation for a household machine can readily reach 1,000 stitches. Industrial sewing machines

arranged for group drive may accomplish as high as 3,500 stitches per minute. A small rheostat actuated by a pedal on the floor permits convenient speed regulation. The consumption of energy varies with the type of machine and the speed. Household sewing machines will require about 25 watts to 40 watts for a speed of 1,000 stitches. High-speed industrial machines consume up to 100 watts at 3,500 stitches. For domestic use an average of 60 per cent operation and 40 per cent rest period may be assumed for the sewing period. Friction drive between motor and flywheel is recommended.—*Siemens Zeitschrift*, August, 1926.

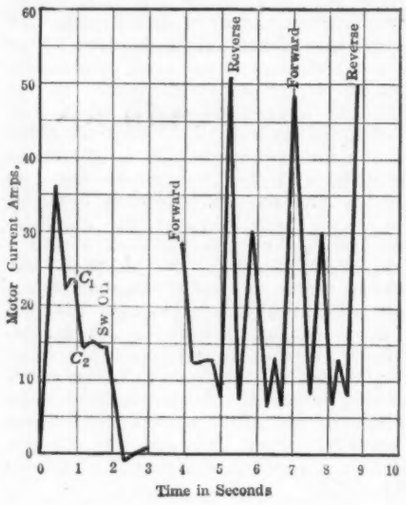
Electrophysics, Electrochemistry and Batteries

Secret Chemicals for Starter Batteries.—K. ARNDT.—The storage battery carried on automobiles for lighting, ignition and starting is usually kept charged by the generator of the car. Excessive night driving or long periods of rest make it necessary to charge the battery occasionally from a source of power supply. This inconvenience is felt particularly by taxicab companies. In the last few years there have appeared on the market a number of chemicals in both solid and liquid form from which, if added to the acid in the cells, more or less miraculous results are claimed. Some of them are said to reduce the time of regular charging to only one-half hour; other claims go so far as to say that emptying, cleaning and refilling the battery with the new liquid obviates any subsequent charge. The nature of these compounds is not divulged. The author secured five of them and submitted them to a chemical analysis and actual trials. The results of the analyses and data from tests are given. All of these chemicals were found to be harmful and none of them fulfilled the claims made. In addition the price asked was from ten to a hundred times the actual cost of the chemicals.—*Elektrotechnische Zeitschrift*, Aug. 12, 1926.

Combination Organic and Inorganic Insulators.—F. GRÜNEWALD.—Solid insulating materials can be divided into two classes, viz., organic, like paper, wood, hard rubber, etc., and inorganic, like porcelain, quartz, glass, mica, etc. The former have great mechanical strength but are not weatherproof, while the latter are weak mechanically, excellent dielectrically and stand the influence of weather. A combination of the two classes would therefore give an electric insulator of perfect quality. An attempt to accomplish this is described. A long rod of "pertinax" (a substance similar to hard paper) has fastened to its two ends metallic toroids to equalize the static field. Suitable metallic clamps at both ends serve to grasp the rod firmly. Such an indoor suspension insulator, with a rod of about 2-in. diameter, will withstand safely a load of 20,000 lb. For outdoor service the rod is incased in corrugated porcelain bushings made in several sections. An upper metal disk and a lower metal toroid insure a suitable potential distribution along the rod. The method of fastening the metallic end clamps is such as to relieve the porcelain casing of all mechanical stress. An insulator of this type for 110 kv. measures about 40 in. in overall length. The author suggests filling the space between the central rod and the inner wall of the porcelain bushings with some insulating compound which does not get brittle at low temperature and does not melt at 60 deg. C.—*Elektrotechnische Zeitschrift*, Sept. 16, 1926.

Traction

Electric Braking.—W. WILSON.—Before proceeding to describe the details of three general methods of electric braking, the author outlines the requirements of an ideal electrically applied brake. He lists as the most important of these the qualification that it must not be liable to get out of order, for, since it is a safety device, it must itself be thoroughly dependable. It must be as simple as possible and must not be subject to any rapid loss of adjustment by wear. The braking effect must be decisive, since the inertia of the motor and the connected load is frequently great. The action must be uniform, in order that the moving parts may be brought to rest within the same distance and in the same period of time on every occasion. The method must be economical, in that it must not consume an appreciable amount of power and must not involve any undue expense in other directions. The braking method must not cause any deteriorating effect on the motor. Mechanically, its action must be smooth, in order that the shaft and windings may not be damaged by sudden alterations of speed. Electrically, the passage of braking currents through the armature must not result in overheating. Finally, whatever additional gear is required to produce the braking must be compact in order that its application to a piece of plant may not seriously increase the bulk or floor area of the latter. Of the three methods of electric braking, the mechanical brake operated by a solenoid is dealt with first on the score of its simplicity. The shoe type of brake is discussed from the standpoint of its easy adaptation for electric operation, particularly as regards its application to machine-tool control and for situations where headroom is limited. The author refers also to the form or reversal of the functions of the motor known as "plugging," which constitutes one of the most effective means of bringing the armature to rest, especially when the rapid reversal of the rotation is to follow. Regenerative braking is taken up last with a short description of its general application.—*Engineering* (*England*), Oct. 8, 1926.



CURVES SHOWING THE FLUCTUATION OF CURRENT WHEN BEING REVERSED IN "PLUGGING" METHOD OF BRAKING

Telegraphy, Telephony, Radio and Signals

Specifications of Receiving Set Chassis and Cabinets.—Information concerning radio products, with the name and address of the manufacturer, is a feature of *Radio Retailing's* editorial service. Extensive lists are presented in this issue on the specifications of receiving-set chassis, cabinets providing for panel and chassis only, and cabinets or tables providing for complete sets, including original cabinet. Portable receiving sets, audio-frequency transformers, receiving sets, loud speakers, head sets and phonograph units, battery chargers, battery eliminators and power units have been similarly treated in the June, July, August and September issues, and specifications of vacuum receiving and rectifying tubes will be printed in the November issue.—*Radio Retailing*, October, 1926.

Miscellaneous

Safety Rules for Electric Toys.—A. MOLLY.—The growing demand for electrically operated toys—in particular for miniature railways—has made it necessary to establish rules covering such articles. Toy trains used to be designed to run with 4 volts to 6 volts direct-current, derived from three or four dry cells, but more recently equipments have been offered by which the trains are operated from a lamp socket. If an alternating-current supply is available, a toy transformer has been interposed, stepping 110 volts or 220 volts down to 8 or 10. If this transformer has two fully insulated windings, complete safety is assured. In some cases, however, an auto-transformer has been furnished. Further use of this device has now been ruled out, because in case of a ground connection on the power line the full-line voltage may occur between train tracks and ground. For direct-current systems two or more carbon-filament lamps have been connected in series with the train or a potentiometer connection with a tapped resistance has been employed. In both cases a "ground" or broken wire causes full-line voltage on the tracks. With series lamps lifting the train off the tracks puts the rails under full voltage. The V.D.E. has therefore ruled that only dry cells or small motor-generators, with a secondary voltage not exceeding 24 volts, are permissible for direct-current toys, or transformers with full insulation between primary and secondary for alternating-current operation. In the last part of the paper the author shows some recent types of toy locomotive motor constructions.—*Electrotechnische Zeitschrift*, Sept. 23, 1926.

News of the Industry

New Station for Detroit

Delray No. 3 Will Have Room for Eight 50,000-Kw. Turbines—Two to Be Ready in 1928

DECISION has been taken by the Detroit Edison Company to build a new generating station, to be known as Delray Power House No. 3. The new building will be erected between the present Delray power house and the river. It will be square with the harbor line, which will turn the building at a considerable angle with the center lines of the existing power houses. The completed plant will have room for eight turbines. It is not unlikely that the turbines will be similar to the last machines installed at Trenton Channel; that is, 50,000-kw. single-barrel units, operating at 400 lb. pressure. Consideration is also being given to a turbine cycle using 550 lb. pressure with cross-compound turbines. If the increased efficiency to be obtained justifies the additional investment in boilers and turbines made necessary by the increase in pressure, this type of turbine may be used.

For purposes of study, the engineering department has assumed that there will be twenty boilers in the completed plant. This figure depends upon the pressure and type of boiler chosen, and when final plans are made the number of boilers may be changed. The boiler proper will be approximately the same size as those already installed at Trenton Channel, with a rating of 3,000 hp., but the coal-burning capacity of each boiler will be more than that of the Trenton Channel boilers. No decision has as yet been reached as to whether the boilers will be fired with stokers or pulverized coal.

The first two units of Delray No. 3 will be put in operation in 1928. The power from these units will be fed through transformers to an existing substation on the site, where it will be distributed to the other substations on the system. Work has been started on the dock which will lie along the river side of the plant. The screenhouse for the new power plant is to be on the present intake canal. Plans have already been made for this building, and construction work will start in the near future. Work is also under way for the planning and construction of the coal-handling equipment for the new plant.

The decision of the company to build the new power house results from a change of plan. The rapid growth of the system load during the past few years has made necessary frequent increase in capacity at the Connors Creek, Marysville and Trenton Channel plants, as well as at Delray. In the fall of 1925 provisional orders were placed for the delivery of two 50,000-kw. units for Delray in 1926. These machines were originally ordered with the idea of removing some of the old vertical turbines in Power House No. 1, to make way for the new machines, and eventually replacing all the verticals of Power Houses Nos. 1 and 2 with a modern turbine installation. This scheme involved several problems which proved rather difficult to solve. The superstructure of the present building would have had to be remodeled to some extent to accommodate the larger machines, and the foundation and substructure of the present building would have had to be entirely rebuilt in order to support them.

Moreover while definite plans were being worked out for installing this additional capacity at Delray, the load had increased to such an extent that it became apparent that if the present machines at Delray were removed to make way for the new machines, the construction work would have to be very carefully scheduled so that the new machines would be ready in time to carry the increased load brought about by the anticipated growth of the system. For this reason and because of the construction difficulties encountered in the rebuilding of Power House No. 1, it was decided to abandon for the present the idea of using the old power-house building for the new turbines. The present machines in Power House No. 1 will be retained, however, for use in emergency standby service.

California and Oregon Stand Firm

Public Ownership Amendments Meet Crushing Defeat on Pacific Coast—New York Election's Bearing on St. Lawrence Development—Hunt May Be Beaten in Arizona

IN EIGHT at least of the states of the Union the results of last Tuesday's election had a more or less direct bearing on the light and power industry or the development of water power by private or public agency.

Foremost in interest probably were the referendums held in California and Oregon designed to put these states in the business of hydro-electric development in competition with existing central-station companies. A dispatch received as the ELECTRICAL WORLD goes to press says that in California the voters rejected, for the third time and by a majority of probably more than two to one, the proposed constitutional amendment under which the state would be bonded for half a billion dollars and a board of five members created which would have power to expend moneys up to this sum for the purpose of acquiring or constructing power plants, transmission systems and distribution facilities for the sale of electrical energy to the public. With the ballots about two-thirds counted, the vote late Wednesday night stood at 126,480 for the amendment and 279,220 against it. In 1922 the act was defeated by a ratio of 2.45 to 1 and in 1924 by 2.35 to 1.

The Oregon amendment, last minute advices to the ELECTRICAL WORLD say, met with an even more decisive defeat, being voted down by about four to one, according to incomplete returns covering 80 per cent of the state. In Multnomah County, where Portland is situated, the vote, nearly complete, is 23,500 for and 79,300 against. Several outside counties are registering even larger majorities against the measure, many of the ratios running five or six to one and in some cases as high as nine to one. From the early returns it appears that only one county may return a slight favorable majority. This is Curry County, a small county in the southwestern part of the state now receiving very little central-station service.

This bill differed from the California bill principally in that the members of the original board of five provided for were named in the act itself, and that, instead of bonds of a definite amount, it provided for the issuance of bonds up to 5 per cent (at present $52,944,000) of the assessed valuation of the state and contained a clause to the effect that any expenditure of more than $500,000 for a single plant must be approved by the voters of the state at a general election.

ST. LAWRENCE SITUATION

Next to the Pacific Coast results, most importance perhaps attaches to the election in New York State. There the sweeping majority for Governor Smith, who carried with him the state officials on the Democratic ticket, with one probable exception, raises an interesting question. The State Water Power Commission, made up of state officials and now solidly Republican, is to meet, probably this month, to consider again the matter of issuing a permit for the development of water power on the St. Lawrence River to one of the two applicants, the St. Lawrence Valley Power Corporation—financed by the Frontier Corporation—and the American Super-Power Corporation. Members of the Water Power Commission have indicated clearly their desire to issue this permit, the applicant first named seeming to be in the more favorable position to obtain it. After Jan. 1, under the plan for the reorganization of the state government which then goes into effect, the Governor can veto any permit the board may issue. Up

to the end of the year he has no such power. But he has publicly declared his intention of watching, in what he deems the interest of the people, the commission's action, and should the board issue a permit before January, he will undoubtedly leave no stone unturned to render it nugatory. He has, already, since election requested the chairman of the board, Conservation Commissioner McDonald, to prevent action before Jan. 1. The leading spirit in the board has been Attorney-General Ottinger, the Republican just alluded to as having probably escaped defeat.

The application of the Malone Light & Power Company for creation of a regulating reservoir on the Salmon River in the Adirondacks, which is now before the State Water Control Commission, with the same personnel, or virtually so, as the Water Power Commission, is little likely to be granted in view of the result of the election and the vigorous attack made on the application by organizations which are opposed to the exploitation of Adirondack water power and which see in the application a "grab" by private interests of public resources without adequate compensation.

IN OTHER STATES

Although Eastern newspapers at first reported Governor Hunt re-elected in Arizona, Thursday morning advices said that the result was still in doubt, the vote (incomplete) then standing: Hunt (Democrat), 37,470; Clark (Republican), 37,036, with 70 precincts to hear from. A dispatch received by the ELECTRICAL WORLD at 3 p.m. said Clark was leading by 65 votes. Defeat of Governor Hunt, the arch-opponent of the seven-state Colorado River treaty, might bring about Arizona's acquiescence in that measure and would also have a favorable effect on the fortunes of the Swing-Johnson Boulder Canyon Dam bill, with the provisions of which ELECTRICAL WORLD readers are familiar.

In Colorado the proposed amendment to the public utilities commission law bringing under commission jurisdiction all public utilities except those municipally owned, thus abolishing the "home rule" feature of the present law, was defeated by a majority of two to one.

In Ohio Governor A. V. Donahey, Democrat, who has been waging war with a Legislature of the opposite party over the personnel of the Public Utilities Commission, was re-elected for a third term by a small majority, and this war, which has culminated in a commission composed of two hold-over members and a third whose term will expire in February, will, the Legislature being once more Republican, presumably go on. One of the charges of the Governor is that the commissioners show undue favor to certain utility companies.

In Maryland Governor A. C. Ritchie has been re-elected. One of the points of attack upon him was his support of the plan for the development of the great hydro-electric plant at Conowingo as it was finally approved by the Public Service Commissions of Maryland and Pennsylvania and the Federal Power Commission. Thus Maryland may be said to have placed the sign of approval on this project, which was attacked as favoring the neighboring state and discriminating against Baltimore.

In Kansas also a lively fight was waged around the Public Service Commission. The Democratic nominee for Governor, former Governor Jonathan M. Davis, conducted his campaign on the issue of forcing public service companies to pay taxes on the same valuations used for rate-making purposes. During his term of office Mr. Davis was instrumental in raising the valuations of utility companies $153,000,000 for taxation purposes. In most instances tax payments on such valuations were made under protest and the affected companies succeeded in having the courts enjoin the tax commission from further collection on the increased valuations. Electric light and power companies bore the brunt of the political attack, and allegations of favoritism to public service companies by Governor Ben S. Paulen, who was renominated by the Republicans, and the Public Service Commission were made, notwithstanding that valuations for rate making have been decreased and that a state-wide investigation of public utility rates is under way. The attack on the commission and the utility companies failed to command the support of the voters, Governor Paulen winning readily.

THE ILLINOIS SENATORSHIP

The election for United States Senator in Illinois was of interest to the utility companies because of the attacks made on candidates who accepted contributions to their primary campaign expenses from Samuel Insull, president of the Commonwealth Edison Company of Chicago and an outstanding figure in utility circles. It was brought out by the senatorial committee of investigation that the successful Republican candidate for the nomination, Frank L. Smith, then chairman of the Illinois Commerce Commission, accepted $125,000 from Mr. Insull and the Democratic nominee, George Brennan, $15,000. This revelation was largely responsible for the nomination of a third ticket by independent Republicans, who chose H. S. Magill as their candidate. The latter failed to poll a very large vote, and Smith won over Brennan by a good plurality but one much under the normal. How much influence disapproval of Mr. Insull's contributions had in changing the vote of individuals cannot, of course, be estimated, many other factors, including the prohibition issue, entering the contest.

Political Accusation Against Portland Electric Fails

Branding the charge that the Portland (Ore.) Electric Power Company had paid to the Portland *Oregonian* $35,000 to help defeat Senator R. N. Stanfield, independent candidate for re-election to the United States Senate from Oregon, as "an unqualified and outrageous falsehood," Edgar B. Piper, editor of the *Oregonian*, made a complete denial of any connection by his newspaper with such a transaction. Mr. Piper's testimony was given in the first day of the investigation of the charge conducted by United States Senator Charles P. McNary of Oregon, a member of the senate investigating committee, at the request of Senator Reed of Missouri, its chairman. The hearing was held at Portland on Oct. 27 and 28. Further unqualified denial of the charge was made by Franklin T. Griffith, president Portland Electric Power Company, and C. M. Clark, chairman of the board. The investigation was ordered by Senator Reed on receipt of what appeared to him to be competent evidence, but which resolved itself into tittle-tattle.

Governor Pinchot Hits Pennsylvania Commission

Governor Gifford Pinchot of Pennsylvania has appointed two new members of the Pennsylvania Public Service Commission—Richard J. Beamish, a Philadelphia lawyer, named to succeed R. W. Martin, whom the Governor has made a judge, and C. J. Golden of Shamokin, an officer of the United Mine Workers, named to succeed J. Henry Scattergood. In naming the new commissioners the Governor was insistent that their function was to represent the people. He said that Mr. Beamish was appointed "mainly and especially because he will bring to his work the firm determination to be fair to the people," adding:

"It is well known throughout Pennsylvania that the present majority of the Public Service Commission is hopelessly controlled by the public utility companies. Instead of being militantly active for the rights of the people, it has been militantly active for the advantage of the corporations, and the consequent loss to the people has been very great. Mr. Beamish represents exactly the opposite point of view. He will be militantly for the people, and his well-known courage in action is the best guarantee that he will be neither driven nor coaxed from what he believes to be right."

In the summer of 1925 Governor Pinchot attempted to recreate the Public Service Commission by removing certain members from office, but the courts denied his power to do so and reinstated the commissioners he had dismissed.

New Hampshire's Largest Utility Starts Operation

The Public Service Company of New Hampshire, recently incorporated to acquire and operate the Manchester Traction, Light & Power Company, the Keene Gas & Electric Company, the Ashuelot Gas & Electric Company, the Laconia Gas & Electric Company and the Souhegan Valley Electric Company, began operation Nov. 1, with headquarters at Manchester. J. Brodie Smith is vice-president and general manager; Walter S. Wyman, president New England Public Service Company, Augusta, Me., is president, and Martin J. Insull, Chicago, is chairman of the board. The new corporation is the largest in the state and represents a total investment of $18,800,000. It serves a population of 190,000, and the

total number of customers on Jan. 1, 1926, was 44,841. Vice-president Smith says that the office building now being erected in Manchester will be increased in capacity to meet the needs of the new company. Mr. Smith has been for many years vice-president and general manager of the Manchester company.

Steps have also been taken by the Insull interests to organize the Vermont Public Service Company to coordinate their properties in the Green Mountain State.

Up-to-Date Transportation Demonstrated

Five Types of Electric Drive Employed in Conveying General Electric Officials and Directors in Novel Business Trip from New York to Bridgeport

FOURTEEN directors of the General Electric Company and others of its officials, including Gerard Swope, president, and Owen D. Young, chairman of the board, made an "all-electric" trip to Bridgeport, Conn., from New York on Oct. 29. They were the guests of E. J. Pearson, president of the New York, New Haven & Hartford Railroad, and the trip was arranged to show modern developments in electric transportation.

On leaving New York the special train was hauled by a standard New Haven electric locomotive operating on a third-rail, 600-volt, direct-current system. At New Rochelle, N. Y., a 60-ton oil-electric locomotive was attached to the train. This new type of locomotive consists of a 300-hp., six-cylinder oil engine directly connected to a direct-current generator and exciter. The engine is a solid injection type with water-cooled cylinders and a compression of about 375 lb. It is operated at a variable speed and the electric power generated is transmitted to motors geared to the axles. In larger switching types two of these units are placed in each locomotive. Designs are made for a single or multiple unit high-speed freight locomotive which will use a 750-hp. engine as standard. The engines are made by the Ingersoll-Rand Company, the electric equipment by the General Electric Company and the locomotive by the American Locomotive Company.

At Stamford, Conn., a motor-generator type of locomotive was next used to haul the special train. This 140-ton locomotive uses single-phase alternating current from the 11,000-volt trolley and changes this to 600-volt direct current on the locomotive by the use of a motor-generator set. At South Norwalk, Conn., the party left their seats and entered a gas-electric car. This unit used a Winton automobile engine directly connected to a generator. It has found a wide application for branch-line service and employs from 210 hp. to 400 hp., depending on the service.

At Bridgeport the party transferred to gas-electric motor buses, which took them to the plant of the General Electric Company. At the plant, after lunch and a directors' meeting, Governor Trumbull of Connecticut and a large group of local business men joined the directors in a trip through the factory.

Much interest was exhibited by those who made the trip, and the thrill induced by riding in the cabs of the five different kinds of locomotive equipments was regarded as a welcome variation to the luxury of private cars. Commenting on the new developments, E. W. Rice Jr., honorary chairman of the General Electric board, said that any use of electricity in railroad operations would help bring about ultimate electrification. The economic field of each kind of equipment is now being defined accurately by field service, and the present prosperous state of the railroads is conducive to the adoption of new types of transportation.

THOSE WHO MADE THE TRIP

Besides Messrs. Pearson, Young, Swope and Rice, those who went to Bridgeport were Oliver Ames, Anson W. Burchard, George F. Morrison and Seward Prosser of New York, George P. Gardner, Francis L. Higginson and Robert Treat Paine 2d, of Boston, B. E. Sunny of Chicago, Jesse R. Lovejoy and Myron F. Westover of Schenectady and B. G. Tremaine of Cleveland, all General Electric directors; G. P. Baldwin, F. C. Pratt and J. G. Barry, vice-presidents of that company, and E. W. Allen, W. B. Potter and W. S. Andrews of its engineer and railway departments; B. Campbell, N. M. Rice, J. A. Droege, G. S. Wheat, H. J. Reynolds, J. H. Harding and W. B. Lasher, officials of the New York, New Haven & Hartford Railroad.

Program of Empire State Electric Meter Section

For its meeting at the Seneca Hotel, Rochester, on Nov. 15 and 16 the Electric Meter Section of the Empire State Gas and Electric Association has adopted the following program, to which, however, another paper will be added:

"A Welcome and an Extensive Viewpoint," E. C. Scobell, general auditor Rochester Gas & Electric Corporation; "What Is a Meter Tester?" E. E. Hill, chairman engineering division Metropolitan Section, N. E. L. A.; "Radio Interference and Hunting Radio Trouble," H. J. Klumb, Rochester Gas & Electric Corporation; "The Evolution of the Induction Watt-Hour Meter," G. A. Sawin, Westinghouse Electric & Manufacturing Company; "Meter Testing on Customer's Premises," E. A. Le Fever, Buffalo General Electric Company; "Quick and Accurate Methods of Meter Testing," H. N. Porter, the States Company; "Checking Phase Sequence," M. A. Zeek, Westinghouse Electric & Manufacturing Company; "European Electric Meter Practice," Herbert Nehls, Landis & Gyr, Ltd.

Many of the papers will be illustrated with lantern slides. Fifteen manufacturers will participate in an exhibit of meters, instruments, timing devices, meter service cabinets and general laboratory equipment. A meter engineers' dinner will be held at 6:30 p.m. on Nov. 15.

Interconnection in "Delmarva" Peninsula

If the territory that has been christened "Delmarva"—the tri-state peninsula formed by the junction of the southern part of Delaware and the eastern portion of Maryland with Virginia on the south—has not bulked large in the electrical news of the day, none the less progress has been made there as elsewhere. The Eastern Shore Gas & Electric Company with the Exmore (Va.) system—both controlled by the General Engineering & Management Corporation, the A. E. Fitkin organization—is about to build a two-unit 12,000-kw. power plant in this district, which it entered less than a year ago. Since the first of February 83 miles of high-tension transmission

ELECTRICAL DEVELOPMENT OF "DELMARVA"

lines have linked important points into the system, and 19 miles more are under way. When the present undertakings shall be completed the peninsula will be linked from end to end in a closely knit system of interconnection. The Exmore plant has been expanded to serve the southern end of the territory more efficiently, and the previously existing 168 miles of transmission line in the northern end have been revamped. Interconnection of the northern and southern ends will come later.

Already transmission lines have been completed or are well along to link Ocean City to Salisbury; Georgetown, Milton and Rehoboth to Laurel; Smyrna to Camden, and Selbyville to St. Martins. When the plans are completed, there will be double-circuit automatic equipment at Salisbury and new substations with automatic equipment at Salisbury and Laurel. There is an up-to-date 4,100-kw. steam plant at Laurel. This will be retained as a standby when the base-load plant now in contemplation goes into service. It has just been decided to build the new plant, for which several sites had been considered, at Vienna, Md., on the Nanticoke River, about 16 miles northwest of Salisbury. This river offers an abundance of circulating water, and transportation of fuel both by water and rail is assured. The location will be close to the center of distribution.

Purchases and Mergers

Two Plants in West Virginia Change Hands—Transfers Are Also Reported from Wisconsin

THE Mountain State Utilities Corporation of West Virginia, owned and operated by the Allied Utilities Corporation, Washington, has just acquired the electric service property in Salem, W. Va., owned by the Salem Electric Company and the electric service property in West Union, W. Va., owned by the Midland Electric Service Company.

The Wisconsin Northern Light, Heat & Power Company, which has been supplying power and light service in a score of communities in Waushara, Waupaca and Winnebago Counties, has been purchased by the Wisconsin Traction, Light, Heat & Power Company of Appleton. Properties taken over consist of more than 50 miles of transmission lines together with local distribution systems which were fed from the lines of the Appleton central-station company.

Permission has been granted by the Wisconsin Railroad Commission to the LaFayette Power & Light Company to acquire the Plank Road Light & Power Company of Elkhorn, while the Woodland Light & Power Company, operating in Herman, Rubicon and Hubbard, will become a part of the Wisconsin Gas & Electric Company.

In addition to the acquisition of the East Missouri Power Company, as noted on Sept. 11 (page 544), the Arkansas-Missouri Power Company, a Fitkin property, has taken over small generating plants or service facilities in seven Missouri communities — Potosi, Bismarck and Irondale, Iron Mountain, Arcadia, Piedmont, Leeper and Poplar Bluff.

Approval of the sale of the municipal electric plant at Granton to the Northern States Power Company is being considered by the Wisconsin commission.

Two more municipal plants in Minnesota have come under private operation —those of Plummer and Middle River, which have both been voted into the system now owned by the Utilities Power & Light Corporation of Chicago.

The American & Foreign Power Company announces that it has arranged to acquire from the Electric Bond & Share Company, with which it is closely allied, all of the latter's holdings in the Havana Electric & Utilities Company, which controls the Havana Electric Railway, Light & Power Company, subject to the stockholders' authorizing, at a meeting called for Nov. 12, part payment therefor in common stock.

No Date Yet Set for Hearing on Indianapolis Merger

A date for a hearing on the proposed merger of the Indianapolis Light & Heat Company and the Merchants' Heat & Light Company will not be set by the Indiana Public Service Commission until the commission's engineers can make a survey of the property of the two companies and check with the companies' engineers the figures and values contained in the petition. The merged company is to be known as the Indianapolis Power & Light Company. The merger involves property higher in value than in any other merger case that has come before the commission. Norman A. Perry, Elmer E. Scott and Charles N. Thompson are named as incorporators of the new organization, which will have the same officers as those now belonging to the Indianapolis Light & Heat. Martin J. Insull, president of the Middle West Utilities Company, has announced, speaking for the Insull interests, that "when the pending deal for the sale of the Merchants' Heat & Light Company and our minority interest in the Indianapolis Light & Heat Company is consummated, we shall be entirely out of the local Indianapolis light and power business."

Engineers Report on Tennessee River

Three Conflicting Applications Covering Eleven Dams Before Federal Power Commission, Involving 250,000 Primary Horsepower—East Tennessee Company's Plan

BY PAUL WOOTON
Washington Correspondent ELECTRICAL WORLD

THE staff of the Federal Power Commission has under consideration reports of the field investigation, conducted by the Corps of Engineers, of three conflicting applications for preliminary permits for extensive power developments on the Tennessee River above Chattanooga and its tributaries, the Clinch and Powell Rivers. The applicants are the Tennessee Hydro-Electric Company, the East Tennessee Development Company and the Union Carbide Company. While the scope of the applications differs considerably, they cover in the aggregate eleven dams, five on the Tennessee, five on the Clinch and one on the Powell, and contemplate the complete development of the power possibilities of the Tennessee River above Chattanooga and the Clinch and Powell Rivers to the vicinity of the Tennessee-Virginia state line. About 250,000 hp. of primary capacity and a probable installation of more than 500,000 hp. are involved.

Definite action by the commission within the next thirty days is probable. Preliminary permits, if granted, will not authorize any construction work; they will require the complete investigation of the sites specified in the permits and will authorize the permittees to submit, as soon as the investigations and designs can be completed, applications for licenses to build and operate the power structures found to be feasible and adapted to the best use of the rivers. In addition to the power to be developed at these dams, they would increase the power obtainable at the government dam at Muscle Shoals, and the lower dams would greatly improve navigation facilities on the Tennessee and the lower Clinch Rivers.

The plans submitted by the applicants are in general accord with the best scheme of development as determined by the Corps of Engineers in the power and navigation survey of the Tennessee River and its tributaries which has been in progress for the past four years.

EAST TENNESSEE'S PLAN

The East Tennessee Development Company's plan is recognized as being of greatest benefit to navigation. Its plan of development was substituted for that contained in two earlier conflicting applications filed by the Tennessee Electric Power Company and the Knoxville Power & Light Company, which were withdrawn in favor of the more comprehensive plan of the East Tennessee Development Company.

The applicants saw nothing to be gained by the conflict and agreed on one project of sufficient size to take care of the needs of both concerns. The two parent companies have no connection except in this construction and operating company. It was incorporated for the sole purpose of carrying out the project. The stock is owned in equal amounts by the National Power & Light Company, of which the Knoxville Power & Light Company is a subsidiary, and by the Tennessee Electric Power Company.

Ninety per cent of east Tennessee now is served by the two companies. The total generating capacity, both hydro and steam, of the two companies at present is 212,464 kw., which is barely sufficient to supply the present demands. If the load continues to grow at the average rate of the past five years, all of the power which it is proposed to develop on the Tennessee will have been absorbed by the end of 1935.

In connection with this application it is pointed out that the demand for power in east Tennessee is such that this project cannot be allowed to await the settlement of the disposition of Muscle Shoals. The primary power at Dam No. 2 and Dam No. 3 at Muscle Shoals, without upland storage, based on the medium-low-water year of 1912, is 116,000 hp. With the East Tennessee Development Company's project in operation the primary power at those dams would be increased to 270,000 hp., or a total development for primary power purposes at Dams Nos. 2 and 3 and on the up-river project of 610,000 primary horsepower. If the Cove Creek dam were built and operated in connection with the Muscle Shoals lease, the best production at the three sites would be 350,000 hp., or 260,000 hp. less than the east Tennessee development. Were the Cove Creek-Muscle Shoals scheme carried out, the sites on the upper Tennessee would be of no value because, engineers agree, they must be operated in connection with Cove Creek in order to make them of practical value.

Interstate Energy Control

O. C. Merrill Explains the Relation of the Federal Power Commission to the Question

HOW far the federal government should go in regulating interstate transfers of energy must be decided in the near future, Executive Secretary O. C. Merrill of the Federal Power Commission declared in the course of remarks before the Philadelphia meeting of the American Academy of Political and Social Science on Oct. 30. Mr. Merrill presided at a session which was devoted to "Power Development and Its Supervision." William A. Prendergast, chairman of the Public Service Commission of New York State, also spoke.

Extracts from Mr. Merrill's remarks follow:

"The question of the development and distribution of electric power is fast becoming one of the most important of our domestic problems, second only to that of transportation. The lighting of our homes and streets, the operation of our industries, our local transportation systems, and to a constantly increasing degree our main-line railroads, are dependent upon the production, transmission and distribution of electrical energy. The volume of electrical energy produced and used is increasing with an extreme rapidity that has created a host of new questions respecting its management and regulation. These demand consideration, if production and distribution are to be controlled in the public interest.

"Supervision or regulation of power development may be directed to one or both of two phases or stages of the problem, to the physical side, such as the plans of development and the construction and operation of the plant, or to the business side, such as the production, transmission, distribution and sale of the product, and to the financing of the undertaking. With respect to the physical side, the state and federal governments have points of contact only where water-power development is involved, for the federal government assumes no supervision over any other type of development, and over water-power development only in those cases where lands or other property of the United States are involved or where the interests of interstate or foreign commerce or international relations are concerned."

Co-operation, Not Antagonism

Alluding to the difficulty of determining where the dividing line in such cases between the jurisdiction of the state and of the nation lies, or whether there is any clearly defined line, whether these jurisdictions are antagonistic or whether the best results in the public interest may be secured by co-operative action, Mr. Merrill said that the Federal Power Commission, which exercises such jurisdiction as the federal government has assumed in the premises, is proceeding on the assumption that co-operation between public agencies will be more effective than antagonism and that wherever the limits of technical jurisdiction may be, there need be no reasonable grounds of conflict if both agencies seek to attain the best results in the public interest.

"With respect to federal versus state regulation of rates, services and securities," he said, "the Federal Power Commission again exercises the only jurisdiction which the federal government has yet asserted, and it exercises it only in respect to its licensees and only in absence of authority in the states to exercise such regulation themselves. Interstate energy transmission is, however, becoming more and more frequent and more and more important. Some of these transactions at least are outside the limits of state authority. To what extent it may become necessary for the federal government, acting either alone or in co-operation with the states, to undertake to regulate such interstate energy transfers is a question that will require answer in the near future; for we can hardly afford to let these transactions of constantly increasing importance remain indefinitely unsupervised and uncontrolled."

Clyde M. Reed Denounces Holding Companies

Issuance of securities by holding companies in the public utility business is "the great financial scandal of the country," Clyde M. Reed, former chairman of the Kansas Public Service Commission, declared in a recent address at Newton before the annual convention of the League of Kansas Municipalities, a state-wide organization favoring municipal ownership.

"Public service commissions of most of the states can and do regulate the securities issued against the physical property of the public utility companies," Mr. Reed said. "There has been no tremendous increase in the issuance of such securities, because permission is granted only after a more or less careful investigation. The financial method of handling the situation has been to organize 'holding companies,' generally under the laws of Maine, New Jersey or Delaware, which proceed to issue stock or bonds of their own. These holding companies are not regulated in the capitalization or issuance of any securities by any authority, state or national. With them 'the sky is the limit'—the sky in this case being the willingness of the public to buy their output of stocks and bonds. These holding companies generally own no physical property directly. The securities are based upon control of public utility properties, scattered all over the country, through ownership of the common stock of such companies." Dividends paid to owners of stock in holding corporations, the speaker asserted, are based on "a wide gap between a 'fair return' upon the property of the public service companies and the earning power of these companies."

"The margin between the 'fair return' and the earning power has been capitalized and is being sold to the public," Mr. Reed added. "It is beyond question that a billion dollars' face value of these securities is water. If there should come a time—and such a time is bound to come—when the rates of public utility companies are adjusted downward to a basis of fair return on the property, these securities will not be worth much more than the paper on which they are printed."

Hearings Resumed on Rates of New York Edison

The hearings which the New York Public Service Commission has been holding intermittently on the rates of the New York Edison Company were resumed last week. They had their origin in a complaint of former Mayor Hylan that rates are too high. The alleged excess was at the latest hearing attributed in part to "improper" accounting charges, this allegation being made by Assistant Corporation Counsel M. B. Fertig, who appeared for the city.

Vice-president H. M. Edwards, in charge of accounting, admitted that an item of $176,000 for "organized expense" included in the capital account represented expenditures which had no connection with the electrical end of the company's business. He testified that one-fifth of the company's assets, valued at $280,000,000, is not devoted to supplying electricity to consumers.

He said that he considered the charge proper because it was made in accordance with the Public Service Commission's accounting rule that all organization expenses should be charged to the capital account. Of the amount, be declared, $88,000 was for fees, taxes and expenses incidental to the reorganization of the financial structure of the company in 1917, when the par stock was changed to non-par.

Mr. Fertig asserted that the public should not be compelled to pay rates on this expenditure because it derived no benefit whatsoever from the change. He also pointed out that in this case, again, one-fifth of the charge was for stock which was intended for the non-electrical end of the business.

New York's Annual Electrical Exposition

The usual success, evidenced by crowds of visitors, marked the nineteenth annual Electrical Exposition in the Grand Central Palace, New York City, which came to an end last Saturday. Striking displays of electrical machinery occupied many booths, and a display of brilliant effects in electric lighting attracted much attention. The predominating feature of the show, however, lay in appliances designed for the service of the home. These included numerous types of electtric washing machines, ironing machines, sewing machines, cleaners, mixers, refrigerators, cooking and baking devices and scores of other appliances to reduce housework, increase leisure or lend themselves to the promotion of health, beauty, convenience or enjoyment.

A notable feature of the exposition was the gathering of more than 650 electrical contractors and dealers on Thursday evening as the guests of Arthur Williams, vice-president of the New York Edison Company and president

of the Electrical and Industrial Exposition, at a buffet supper which was served in the booth of the home economics department of the company. Later the dealers inspected the exhibits in a body. They also listened to an address on "The Real Significance of the Electrical Exposition," which was given by Frank W. Smith, vice-president and general manager of the United Electric Light & Power Company, in the special broadcasting studio at the exposition. "In all these displays," declared Mr. Smith, "there is but one aim—to serve mankind. There we find the key to what we seek. Lighter tasks for people in all walks of life, more leisure for those to whom leisure was once denied, and the means by which the work of women may be raised to a plane with the work of men—that is the meaning of the exposition."

The total attendance at the Electrical Exposition was in the neighborhood of 100,000.

Pre-License Costs of Conowingo Put at $2,000,000

A joint conference to determine the pre-license costs of the Conowingo power project was held last week by representatives of the Maryland and Pennsylvania Public Service Commissions and the Federal Power Commission in the offices of the Maryland commission. In the license for the enterprise issued Feb. 20 last by the federal commission it was provided that promotion costs of the undertaking should be determined by Sept. 20, but the date has been extended to Nov. 20.

A further hearing at Baltimore or Washington will be called within the next few weeks and an opportunity will be given the Conowingo interests to present their claims. Commission auditors who have been studying the matter during the last year will testify in the interest of a fair valuation and allocation of pre-license costs. Following last week's conference, the Maryland commission made public this statement:

"A committee composed of representatives of the three commissions and known as the committee on pre-license costs of the Conowingo project, which committee has been working for more than a year, has recently completed its preliminary investigation, and it is understood its report will show expenditures in connection with the project since May, 1922, amounting to $2,448,945. Of that amount the committee concludes that $1,090,253 may be treated as a charge to the property investment accounts for the project; that $645,822 does not represent an investment in the project, and that expenditures of $712,870 are of a controversial nature, the allocation of which between property investment and other accounts cannot be determined until further and more specific information has been obtained.

"The committee will further suggest an amount not in excess of $2,000,000 as representing the pre-license cost of the project prior to May, 1922, represented by stocks issued by the Susquehanna Power Company."

Briefer News

Louisville Organizes Section of A.I.E.E.—Electrical engineers of Louisville, Ky., organized the Louisville Section of the American Institute of Electrical Engineers last week at a meeting addressed by Arthur G. Pierce of Cleveland, vice-president of the second district of the Institute. Officers elected were: Chairman, Prof. D. C. Jackson, Jr., and secretary-treasurer, W. C. White.

Oil-Electric Locomotive in Lumber Service.—Maximum grades of from 2 to 3 per cent are conquered by the silent 100-ton oil-electric locomotive which daily hauls cars loaded with huge logs out of the woods to the Red River Lumber Company at Westwood, Cal., 20 miles away. The oil-electric locomotive, a joint product of the American Locomotive, Ingersoll-Rand and General Electric Companies, is being used by several railroads for switching service and at a Western copper mine as well.

Central-Station Representatives of Four Middle States to Confer. — Arrangements are being made for a meeting in Kansas City in November of representatives of the electric light and power companies operating in Kansas, Missouri, Iowa and Nebraska, for the purpose of going over the situation in these states with respect to competitive bidding for municipal and privately owned plants. This is said to have resulted in a number of instances in payments of more than the purchased property is worth. The conference will take up also the question of how best to increase income so that the capital stock values will be justified from the standpoint of revenues, and a campaign will be launched to sell service more widely.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, July 3, page 50.]

National Association of Railroad and Utilities Commissioners—Asheville, N. C., Nov. 9-12. J. B. Walker, 270 Madison Ave., New York.

American Engineering Council—Administrative board, Ithaca, N. Y., Nov. 11 and 12. L. W. Wallace, 26 Jackson Place, Washington, D. C.

American Institute of Electrical Engineers — Regional meeting, New York, Nov. 11-12. F. L. Hutchinson, 33 West 39th Street, New York.

Electrical Credit Association of Middle and Southern Atlantic States—Philadelphia, Nov. 12. J. McCrum, 1211 Arch St., Philadelphia.

Empire State Gas and Electric Association — Electric Meter Section, Hotel Seneca, Rochester, Nov. 15 and 16. C. H. B. Chapin, Grand Central Terminal, New York.

American Welding Society — Buffalo, Nov. 16-19. M. M. Kelly, 29 West 39th Street, New York.

American Society of Agricultural Engineers, Farm Power and Machinery Division—Chicago, Dec. 1 and 2. Raymond Olney, St. Joseph, Mich.

American Society of Mechanical Engineers—New York, Dec. 6-9. C. W. Rice, 29 West 39th St., New York.

Northwest Association of Electrical Inspectors—Multnomah Hotel, Portland, Ore., Jan 18 and 19. F. D. Weber, Box 745, Portland.

War Department Approves 132,000-Volt Cable Over Delaware River.—The War Department has approved an application by the Buck Falls Electric Company of Pennsylvania and the Public Service Gas & Electric Company of New Jersey for construction of a 132,000-volt power cable across the Delaware River about 2 miles below the Pennsylvania Railroad bridge at Trenton, N. J.

More than 100 Visitors a Month See Model Electric Farm.—The operation of model electric farms by Wisconsin power companies is attracting wide interest, which is reflected by the number of people who visited the electric dairy farm of the Southern Wisconsin Electric Company in the seventeen months from April 1, 1925, to Sept. 1, 1926. This number reached 1925, an average of more than 100 visitors a month. More farms of this kind are to be established by the Wisconsin Power & Light and other Wisconsin central-station companies.

Highway Lighting from Jacksonville to Pablo Beach, Fla., Completed. — The placing of 250 General Electric "Novalux" units on the 15 miles of road leading from South Jacksonville, Fla., to Pablo Beach makes that highway one of the best lighted in the country. The lamps are spaced 300 ft. apart on a pole line set for the purpose and are on one side of the road only. They operate 250-cp. lamps and are 30 ft. above the surface. As this is the main thoroughfare leading from South Jacksonville to the beach the traffic during the summer is very heavy. Since the lighting units have been installed there has been a noticeable decrease in accidents.

Army Engineers Disapprove "All-American" Waterway. — Advocates of the proposed St. Lawrence waterway, with its attendant hydro-electric features, were pleased last week when the board of army engineers to which consideration of the rival or "all-American" channel plan had been referred announced its disapproval of the latter. The "all-American" route would deepen the Barge Canal across New York State from Oswego to the Hudson, thus connecting the ocean and the Great Lakes for shipping purposes. An earlier army engineer report was also adverse, putting the cost of the project at the prohibitive figure of half a billion.

Power Section Meeting of Bituminous Coal Conference.—The Carnegie Institute of Technology has announced a conference on bituminous coal to be held at Pittsburgh on Nov. 15 to 19. This conference will take up improved methods of utilization and combustion, and a number of distinguished European and American technologists will take part.

The Power Section, meeting on Nov 16, will discuss power at the mine, colloidal fuel, transportation of powdered coal and similar topics. Among the members of the advisory board assisting in the development of the conference plans are Secretary Mellon, John Hays Hammond, Otto H. Kahn, Charles M. Schwab, Samuel Insull, E. M. Herr and Frank B. Jewett.

Date Set for Start of Gatineau River Plants.—Major Brace of the Fraser-Brace Engineering Company, which is building the great power plants on the Gatineau River, Quebec, for the International Paper Company, announces that the first of the five power units to be installed at the Chelsea plant will be in operation by Jan. 1 of next year, while the wheels of the Farmers' Rapids plant will probably begin to revolve early in March.

Pawnee City, Neb., Refuses to Sell Municipal Plant.—By a vote of 504 to 147 Pawnee City, Neb., has defeated a proposal submitted by the City Council favoring the sale of the municipal electric light plant to the Nebraska Gas & Electric Company for $120,000. Vigorous opposition was made by municipal ownership advocates. The Nebraska Gas & Electric had originally offered to sell electricity at 3 cents a kilowatt-hour, which is below the city's price.

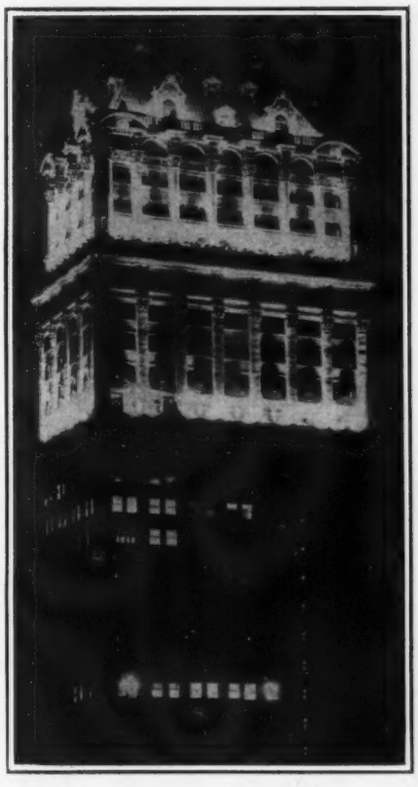
The Aroostook to Have New Hydro Development. — The Atlantic Public Utilities, Inc., Boston, has awarded contract for a new dam and reservoir on the Aroostook River in connection with additions to its hydro-electric development at Caribou, Me., for the Caribou Light, Water & Power Company, a subsidiary of the Atlantic corporation. Plans provide for a reservoir to contain 200,000,000 gal. The Ring Construction Company of Bangor has the general contract, which calls for an expenditure of more than $1,000,000.

New Water-Power Project for American River.—Application has been filed with the California Division of Water Rights by the American River Water & Power Company, which has headquarters in San Francisco, for a permit to divert 200 sec.-ft. from the North Fork of the American River and to store 50,000 acre-ft. of water. This application is probably intended to supersede previous filings, interests having changed hands. Plans contemplate a power project in French Meadows, Placer County, including a reservoir near the town of Donner and a dam 30 ft. high. The estimated cost of the development is $1,000,000.

Columbia Basin Irrigation League Sees Potential Development of Half a Million Horsepower. — Secretary Hoover's recent inclusion of the Columbia Basin development project in the State of Washington among the seven major water developments which will be necessities in the United States in the near future has spurred the Columbia Basin Irrigation League to fresh endeavors to promote the scheme. Although primarily a reclamation project, the league asserts that the storage contemplated will make it possible to generate 500,000 hp., which can be marketed at less than the price in other Northwest districts. Besides the Columbia Basin scheme, Mr. Hoover instanced as undertakings that ought to be carried through in from ten to twenty years those connected with (1) the Colorado River, (2) the Sacramento and San Joaquin Valleys, (3) the Mississippi Valley, (4) the Missouri Valley, (5) the coastal waterway and (6) the Great Lakes project.

Interconnection Under Way Between Falls Village, Conn., and Poughkeepsie, N. Y.—The Connecticut Power Company of New London, Conn., has started work on a 60-mile extension to its high-voltage transmission system. The new line will extend from Falls Village, Conn., to Poughkeepsie, N. Y., and will form the connecting link in continuous transmission lines between Hartford and Niagara Falls. Its main object is to provide more efficient service throughout western Connecticut and guard against possible interruption of service, but it will also make it possible for the Connecticut Power Company to supply power to Poughkeepsie, and the Adirondack Power & Light Company will be in a position to return the service when occasion arises.

Illumination of Detroit's New Skyscraper



THE Book Tower of Detroit, the upper half of which is shown here with the topmost stories floodlighted, is 39 stories high with a total elevation of 475 ft. The walls of the building are belted with 48 General Electric projector floodlamps, equipped with amber glass doors, on the twenty-eighth floor, and on the thirty-third floor with an equal number of lamps equipped with ross-glass doors. The roof is lighted by eighteen projectors and fourteen Ivanhoe angle reflectors with clear glass. The projectors are all equipped with 500-watt "Mazda" floodlighting lamps and the reflectors with 200-watt standard "Mazda" lamps.

Bureau of Standards Anniversary.—A celebration of the twenty-fifth anniversary of the Bureau of Standards of the Department of Commerce will take place on Dec. 4, when the bureau will keep open house and a banquet will be given.

Danville, Va., to Vote Dec. 19 on Sale of Its Plants.—After protracted discussions and negotiations, the Danville (Va.) City Council has recommended the transfer by the city of its electric and gas plants to the Appalachian Power Company and has set Dec. 19 as the date of a referendum on the proposal. The power company offers $2,750,000 cash for a 30-year non-exclusive franchise. The electric light rate to domestic users would remain as at present, but the rate to large users of power would be lowered. A feature of the negotiations was the admission that for the last five years the gas and electric plants, which have been operated by the city for 30 years, have been maintained at a loss of more than $100,000. The popular impression had been that all the utilities were paying.

Program of Electrical Credit Association. — At the thirty-first annual meeting of the Electrical Credit Association of the Middle and Southern Atlantic States, to be held at Philadelphia on Friday, Nov. 12, Freas B. Snyder, president Brotherhood of Locomotive Engineers Title & Trust Company, will speak on installment credits, E. W. Hillman of the Doubleday-Hill Electric Company, Pittsburgh, will conduct an open forum, and W. J. Kreger, secretary New York Electrical Credit Association, will tell how this association protects its members from fraud. At the dinner in the evening Joseph Morse will discuss "Personal Equations in Credit Granting."

Development of Colorado River of Texas to Start Soon.—Announcement that construction will start soon on the first of the projected series of six dams to be built in the Colorado (Texas) River for the purpose of storing water for large hydro-electric plants is made by the promoter, the Syndicate Power Company of Dallas. This dam will be built at Kingsland and will be 2,500 ft. long and 165 ft. high. The water will be backed up 34 miles and the reservoir will store 831,020 acre-ft. The appropriation allowed by the Board of Water Engineers is 1,225,700 acre-ft. It is estimated that three years will be required to construct the dam. The Syndicate Power Company is headed by C. H. Alexander, Jr., Dallas, and is understood to be backed by the Insull interests in Texas. An outline of the company's plans appeared in the ELECTRICAL WORLD for April 10 last, page 779.

Men of the Industry

H. B. Ivers in Boston

Harry B. Ivers has joined the staff of C. D. Parker & Company, Inc., Boston, as head of a new department to co-ordinate the activities of various local utility and industrial properties under the management of this house, with the major objective of reducing operating loss items and increasing revenues. He will report to Vice-president Bowen Tufts. Mr. Ivers has had a long and notable career in the public utility field. He entered the employ of the Norfolk Suburban Street Railway at Hyde Park, Mass., in 1893 and in nine years rose to the post of assistant treasurer of the Old Colony Street Railway, which absorbed that property and the Hyde Park Electric Light Company during that period. For four years he was treasurer and manager of the electric railway, lighting and gas properties at Westerly, R. I., going from there to the Milford (N. H.) Electric Light Company, where he engaged in hydro-electric development. In 1907 he became treasurer and assistant to the president of the Bangor (Me.) Railway & Electric Company, and after two years he was made general manager of the Cumberland County Power & Light Company, Portland, Me., also serving for about eight years as general manager of the Lewiston, Augusta & Waterville Street Railway. Since 1917 he has been engaged in various activities, including a connection with the banking house of P. W. Brooks & Company, New York, under which he purchased utility properties in the Southwest and made investigations.

Samuel Insull, president of the Commonwealth Edison Company, Chicago, returned from Europe, Oct. 29, aboard the Cunarder *Berengaria* after a short sojourn abroad. Mr. Insull visited London, Paris and other cities.

George O. Bason, district commercial manager of the Newburgh district of the Central Hudson Gas & Electric Company, has resigned. Mr. Bason has affiliated himself with the Conduit Electric Manufacturing Company at Boston.

H. L. Hendon, who has been affiliated with the Carrollton office of the Georgia Railway & Power Company, has been appointed manager of the company's Gainesville district to succeed J. G. Nelms, recently transferred to Rome.

C. V. Merriam, superintendent of distribution of the Eastern Texas Electric Company, Beaumont, Tex., has been transferred to Huntsville (Tex.) as superintendent of the Western Public Service Company. Both of these properties are under the executive management of Stone & Webster.

Harry L. Walther, for many years identified with the public utility business in southern Oregon and more recently manager of the southern Oregon properties of the California-Oregon Power Company, Medford, has been chosen manager of the Oregon Public Utility Information Bureau, with offices in Portland. After extensive experience in the railway field Mr. Walther entered the power business in 1911 as general manager of the Rogue River Electric Company at Medford. In the following year, when that company was consolidated with other properties under the ownership and operation of the California-Oregon Power Company, Mr. Walther was made manager of the southern Oregon properties, which position he retained until he was chosen by the utility companies of the state to head the reorganized Public Utility Information Bureau.

W. R. Bell of El Paso Receives Promotion

W. R. Bell, sales manager of the El Paso (Tex.) Electric Company, has been promoted to the position of superintendent of light and power to succeed

W. R. BELL

C. F. Terrell, who has assumed new duties in Tampa, Fla. This appointment to a position of greater responsibility is a fitting recognition of the ability with which Mr. Bell has directed the work of the sales department since his arrival in El Paso two years ago. He has been identified with Stone & Webster companies since 1906, his first affiliation being with the Paducah (Ky.) Electric Company. At that time he was still attending school, working during his vacation periods. Mr. Bell received his technical education at the Rose Polytechnic Institute, Terre Haute, Ind., having been graduated in electrical engineering in 1912. The following year he was made assistant superintendent of the Baton Rouge (La.) Electric Company, subsequently becoming sales manager. In 1920 he was made sales manager of the Haverhill (Mass.) Gas Light Company, where he remained until his transfer in 1924 to El Paso.

C. J. Golden of Shamokin, Pa., has been appointed a member of the Pennsylvania Public Service Commission by Governor Pinchot to serve out the remainder of the term of J. Henry Scattergood, expiring July 1, 1929. Mr. Golden has been a prominent figure among the union miners of the anthracite fields for several years, at the present time being president of District No. 9, United Mine Workers of America. The Governor has also recently named **Richard J. Beamish** to be a member of the commission.

Donald M. Libby has been appointed power engineer of the Cumberland County Power & Light Company, Portland, Me., succeeding H. Burgi, Jr., resigned to enter the waterworks field.

John Anderson, vice-president in charge of power generation of the Milwaukee Electric Railway & Light Company, has been appointed a member of the Milwaukee Sewerage Commission.

T. W. Wilson, who has been superintendent of the Franklin district of the Georgia Railway & Power Company for several years, has been transferred to Carrollton as superintendent of that district.

William V. Holik, formerly connected with the distribution department of the Blackstone Valley Gas & Electric Company, is now superintendent of distribution of the Eastern Texas Electric Company at Beaumont.

L. C. Peterman, formerly connected with Dwight P. Robinson & Company, has joined the electrical division of the engineering department of the General Engineering & Management Corporation, New York.

M. L. Cummings, Jr., of the Utah Power & Light Company, has been made managing editor of the *Utah Engineer*, a new sheet published in the interest of the engineering fraternity of that state, the first number of which has just appeared. **Ralf R. Woolley**, a well-known hydraulic engineer, now in charge of the United States Geological Survey in the Salt Lake territory, is editor.

L. A. White, who has been connected with the Oklahoma Gas & Electric Company at Oklahoma City, has been appointed superintendent of the electric department of the company's eastern division. Mr. White is not unfamiliar with the Muskogee district, having been formerly general superintendent in that territory. He is succeeding Leo Valentine, who has been transferred to one of the other divisions of the Oklahoma Gas & Electric Company.

Anson W. Burchard, vice-chairman of the board of directors of the General Electric Company, was elected president of the American Arbitration Association at the annual meeting and election of officers held Oct. 30. This organization has carried on a nation-wide and a world-wide inquiry into the best way to make the United States the leader in commercial peace and the exponent of good will in trade relations. The plans of the association are made possible through 243 trade organizations, chambers of commerce, boards of trade and other commercial bodies which have affiliated with it.

Charles M. Keebler, formerly supervisor of the New Jersey properties of the General Engineering & Management Corporation, has formed a new operating department at the company's headquarters in New York. Mr. Keebler joined the General Engineering

& Management Corporation after a long association with the New Jersey Public Utility Commission, and since his affiliation with the former organization he has frequently adjusted various rate matters in the Fitkin utility system. As rate and budget engineer Mr. Keebler will direct the work of the new department, acquiring all information necessary to compile the construction and operating budgets.

L. E. Weber, local manager of the Jersey Central Power & Light Company at South Amboy, N. J., has been transferred to Tyrone, Pa., as general superintendent of the Home Electric Light & Steam Heating Company.

C. C. Cox has been appointed division engineer of the Oklahoma Gas & Electric Company at Enid to succeed H. B. Brigham, who has been transferred to Oklahoma City.

W. M. Edmonstone has been appointed production manager of the Doble Engineering Company, with headquarters at the factory, Medford Hillside, Mass.

Samuel C. Schmulbach, who has been connected with the Illinois Power & Light Corporation at East St. Louis, Ill., has been transferred to Cairo, Ill., to be district manager for the Cairo, Mounds and Mound City districts of the company.

T. C. Shipley, manager of the Rushville (Neb.) properties of the Nebraska Electric Power Company, has been placed in charge of recently acquired plants in that section, with headquarters at Gordon.

Leo Valentine, formerly superintendent of the eastern division of the Oklahoma Gas & Electric Company, was transferred to the northern division of the company Nov. 1 to become chief electrician. Mr. Valentine has been affiliated with the Oklahoma organization for the past fourteen years.

E. L. E. Wheatcroft has just been appointed to the newly created chair of electrical engineering at the University of Leeds, England. Mr. Wheatcroft's academic career at Cambridge was one of unusual distinction, and his practical training was gained in the works of the British Thomson-Houston Company, Ltd., and later with the General Electric Company at Schenectady, N. Y. He has had an extensive experience in certain phases of heavy electrical engineering, particularly in regard to problems relating to the generation and transmission of power, and has carried out considerable research work.

G. C. Barry has been appointed assistant to E. G. Hines, general sales manager of the American Brown Boveri Electric Corporation, New York, manufacturer of heavy electrical equipment. Mr. Barry began his electrical career with the Western Electric Company in 1912, three years later becoming associated with the Hart Manufacturing Company of Hartford, where he remained until the outbreak of the war. In 1923 he returned to the Hart company as sales manager, with offices in New York, and was soon after appointed general sales manager at Hartford, during which connection he personally established several branch offices of the company in Europe.

Thomas S. Knight, who was recently appointed manager of the New England district of the General Electric Company, with headquarters at Boston, as announced in the Oct. 9 issue of the ELECTRICAL WORLD, has been assistant district manager in that territory since 1921. He was graduated from Tufts College in 1903 and after passing through the testing department at Schenectady was transferred to the Pittsfield works. Later he returned to the switchboard department at Schenectady and in 1908 was transferred to the engineering department at the Boston office. He served seven months with the War Industries Board in Washington in 1918 and is one of the most highly regarded sales executives in the New England electrical industry.

C. F. Terrell Now in Florida

C. F. Terrell, formerly superintendent of light and power of the El Paso Electric Company, has been appointed general superintendent of light and power of the Tampa (Fla.) Electric Company. Mr. Terrell leaves behind

C. F. TERRELL

him in El Paso an excellent record of achievement in directing the construction program of the company during the past two years. His affiliation with the Stone & Webster organization dates back 22 years. In 1904 he joined the Seattle Electric Company. He remained with that company and its successors until he was transferred to El Paso two years ago. Mr. Terrell has been actively identified with many civic movements in El Paso, including the Chamber of Commerce. He is a member of the American Institute of Electrical Engineers.

James W. Loose, consulting engineer, has entered the employ of the H. Lee Reynolds Company, manufacturers' representative, Pittsburgh. Mr. Loose has just completed a street-lighting installation at Steelton, Pa.

William M. Green, engineer in charge of the investigation of the Great Basin reclamation project in Utah, on behalf of the United States Reclamation Service, has resigned from the service to accept a position with the J. G. White Engineering Corporation in Mexico. This firm is engaged in reclamation work for the Mexican government and private interests.

Obituary

Thomas I. Stacey, secretary and treasurer of the Electric Appliance Company, Chicago, died suddenly Oct. 24 in his fifty-sixth year. He began his career in the electrical supply business with the Central Electric Company, Chicago, in 1887, remaining with that organization until 1890. Then began 36 years of association with W. W. Low, resulting in the formation of the Electric Appliance Company in 1891, of which Mr. Low became president and Mr. Stacey secretary and treasurer.

Sir Ernest Maes Harvey, a director of the British Columbia Electric Railway Company and a member of the firm of Allan, Harvey & Ross, bankers of London, England, died in London, Sept. 13.

Robert E. Moran, city electrician for 42 years in Memphis, Tenn., died Oct. 22 after an illness of 24 hours. For 43 years he had lived in Memphis and for all but one had served in the capacity of city electrician and chief electrical inspector.

Claude R. Alling, vice-president of the Underwriters' Laboratories, died Oct. 25 of an illness which had stricken him a little over two weeks before. The end came in Evanston, Ill., where he spent most of his life. Mr. Alling received his college training at Denver University, Northwestern University and Armour Institute. From the last-named institution he was graduated in 1907 with the degree of bachelor of science. In June of that year he became associated with the Underwriters' Laboratories as assistant to the late W. C. Robinson. The thorough manner in which he familiarized himself with and handled the problems in the different departments in which he served made him the logical choice of the board of directors when a vice-president was to be chosen last February. Through his work at the Underwriters' Laboratories and his active memberships in technical and insurance societies the cause of fire prevention always had stanch support.

Dr. Hazen G. Tyler, professor of experimental engineering at New York University and director of the university's evening engineering division, which he organized, died Oct. 27 at the Misericordia Hospital, New York, after a short illness. Dr. Tyler's earliest connection in the electrical industry was with the New York Edison Company and followed graduation from the Polytechnic Institute of Brooklyn. From 1912 to 1916 he engaged in consulting work with William D. Ennis and subsequently was identified with the Western Electric Company and with the Slocum, Avram & Slocum Laboratories, Inc. His academic work included connections with the teaching staff of the Polytechnic Institute of Brooklyn, his alma mater; Rensselaer Polytechnic and New York University. Dr. Tyler was a member of the A.I.E.E., the A.S.M.E., and the S.P.E.E.

Commission Rulings

New Hampshire Commission Forbids Invasion of Electric Territory.—Authority to extend electric service into the territory of another utility company has been denied by the New Hampshire Public Service Commission in a case affecting the Salem Electric Light Company. The commission said that the propriety of the present rates of the existing utility might be heard in a proper proceeding, but continued: "The question herein is whether or not an electric utility shall be permitted to enter territory which has heretofore been asigned to another utility in the same line of business. The petitioner seeks a right to operate in territory all of which is included in an area previously given to Fred D. Tootell. To allow such an invasion tends to inadequacy of service. Competing lines in the distribution of power covering the same locality bring about a duplication of capital as well as a waste in equipment and in operation, and eventually the loss ensuing from such an undertaking falls upon the consumer."

Power of Commission Over Management.—As reported in the ELECTRICAL WORLD for Oct. 9 (page 771), the Public Service Commission of Maryland in granting to the city of Hagerstown the right to build a new municipal plant, despite the protests of the Potomac Edison Company, held that the point at issue "transcended a mere problem in economics." "While it is true," the decision held, "that the commission deplores competition in the utility field, it does not believe it to be its function to destroy competition where it existed prior to the establishment of the commission by exercising its powers to the advantage of one and to the disadvantage of the other of two competitors. It does, however, feel that it would be its duty to prevent the invasion by a new plant, whether private or municipal, of a field already being satisfactorily served by an existing company, and this it stands ready to do." Answering one point raised by the company, the commission said further: "Counsel for the protestants have stressed the orders of the commission granting permission to the company, at its request, to build new plants and to issue new securities as orders from the commission to go ahead and do these things irrespective of what the company's judgment might be. At no time did the commission on its own initiative 'order' the company to build any new plant or make any large capital investment. It did not attempt to substitute its judgment in such matters for that of the company's board of directors. It did not undertake the management of the company. Upon applications properly filed, it held hearings, and on the evidence submitted, and in the absence of protests, it found such new power stations as the company asked permission to erect and such new issues of securities as the company desired to put out to be reasonably required for the lawful purposes of the company. But to infer from such action of the commission that it is legally or morally bound to take any steps that will prevent the reasonable and natural growth of a competing plant which had been in operation for many years before the days of regulation, and that will lead to the ultimate destruction of such competitor, is to give to the orders of the commission an interpretation they were never intended to have. The company made its extensions of plant and its large investments in the exercise of its own business judgment as to what would be required of it. The interconnection with lines of other companies operating outside the state was not before the commission at all. On statements of its own counsel it paid no attention whatever to what its competitor was doing or what it proposed to do. It went ahead and provided facilities which would be sufficient to supply every demand that could be required of it for at least five years to come even if the present municipal plant should be scrapped. That would seem to be a duplication of the existing plant of the municipality, certainly not required by public convenience and necessity. If the Potomac Edison Company made expenditures for the purpose of securing even a part of the business of the municipal plant, it did so with full knowledge that, so far as the extension of facilities of the municipal enterprise was concerned, the city of Hagerstown intended to go ahead, if there were any possible way of doing so."

Recent Court Decisions

Right of Electric Company to Use Abandoned Canal Under State Lease Upheld.—The United States Supreme Court has denied a petition for a writ of certiorari whereby the city of Toledo, Ohio, sought to have the court review a decision by the Circuit Court of Appeals in favor of the Maumee Valley Electric Company. The company sought to enjoin the city from interfering with flow of water through an abandoned section of the Miami & Erie Canal, on the ground that it had a right to use the water for hydraulic power by virtue of a lease from the state. The state in 1920 sold this part of the canal to Toledo and the city started work to divert the water. The district court refused an injunction to the company, but this decision was reversed by the Court of Appeals, whose judgment is now confirmed.

Power Company Held Not Responsible for Leakage of High-Voltage Current Into Telephone Lines.—A power company cannot be held responsible for the leakage of current from a high-voltage transmission line into the lines of a telephone company with consequent damage to the switchboard of a commercial institution. That was the feature of a decision handed down by a jury in the Circuit Court at Sheboygan, Wis., in favor of the Wisconsin Power & Light Company, from which damages were sought by the Providence Washington Insurance Company. The insurance company was called upon by a hardware company in Sheboygan to pay a loss resulting from damage to the hardware company's switchboard. High-voltage current from the power company's lines had escaped from its proper channels into the lines of the Citizens' Telephone Company, causing the injury to the hardware company's switchboard. The decision of the jury was influenced by the fact that testimony showed that neither of the utility companies was negligent.

Valuation of Land for Water-Power Rights.—Supporting the refusal of the lower court to strike out certain testimony bearing on the value of water-power rights, the United States Circuit Court of Appeals for the Seventh Circuit said, in Ford Hydro-Electric Company vs. Neely: "The evidence objected to threw light upon the availability of the land for water-power purposes and the value of such element, as bearing upon what might be paid for it by one desiring to purchase it, and thus bore upon its market value. By objecting to this evidence, plaintiff in error sought to exclude it altogether. As remarked by the trial judge, the objection went rather to the weight to be given the evidence than to its competency. The availability of the land for the development of water power and the value of it for such purposes was a proper element to be considered by the jury in fixing its market value. The point made that the witnesses 'considered the lands as a part of a united whole, the whole consisting of all the parcels of land necessary to a completed water-power development which would include the lands taken,' does not impress us. The argument appears to be that where the lands sought to be condemned are not the whole of the lands needed, but only a part thereof, the elements called by the trial judge 'raw-water-power value of land,' and by the Supreme Court 'its capability of being made available' for such purpose, cannot be considered at all in determining value. From the arguments of plaintiff in error we conclude that its real grievance is that the jury gave too much consideration to the element of potential water power. This being an element proper to be considered, it could not be excluded, but plaintiff in error should have asked the court to instruct the jury that it should take into consideration the probability or practicability of so uniting all the lands as to make the water power appertaining to the lands of defendants in error available. The authorities cited by plaintiff in error recognize the propriety of such evidence. Plaintiff in error did not ask the court so to instruct the jury, but planted itself on the incompetency of the evidence and cannot now complain that this evidence was given too much weight." (13 Fed. [2d] 361.)*

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Financial and Corporate

Utility Markets Are Firm

Elections Occasioned Some Profit Taking, but Prices Generally Showed No Material Decline

IT IS scarcely possible to point to any definite trend in the markets during the past week, broken first by the week end and then by Election Day. Any semblance of a movement in the general market is upward except for the normal amount of profit taking which such an event as an election usually occasions. It is yet too early to know what the post-election market is going to do. The past offers a diversity of precedents in this respect, and there seems to be no general rule to go by.

The public utility markets are in about the same position. Although the week has been characterized by irregular movements, the undertone has continued strong. Profit taking prior to the elections led to some sizable reactions, but there were just about as many gains as losses. This was due, apparently, to rumors of extra dividend distribution in certain issues and to some specially favorable earnings statements. Among the common issues, Electric Bond & Share Securities Corporation stock gained three points to 68½. Northeastern Power gained approximately two points. American Gas & Electric receded slightly to 105. Few changes of any significance took place among the preferred issues.

There is still keen demand for sound public utility bonds, especially operating company bonds selling below par. Price changes have, however, been rare.

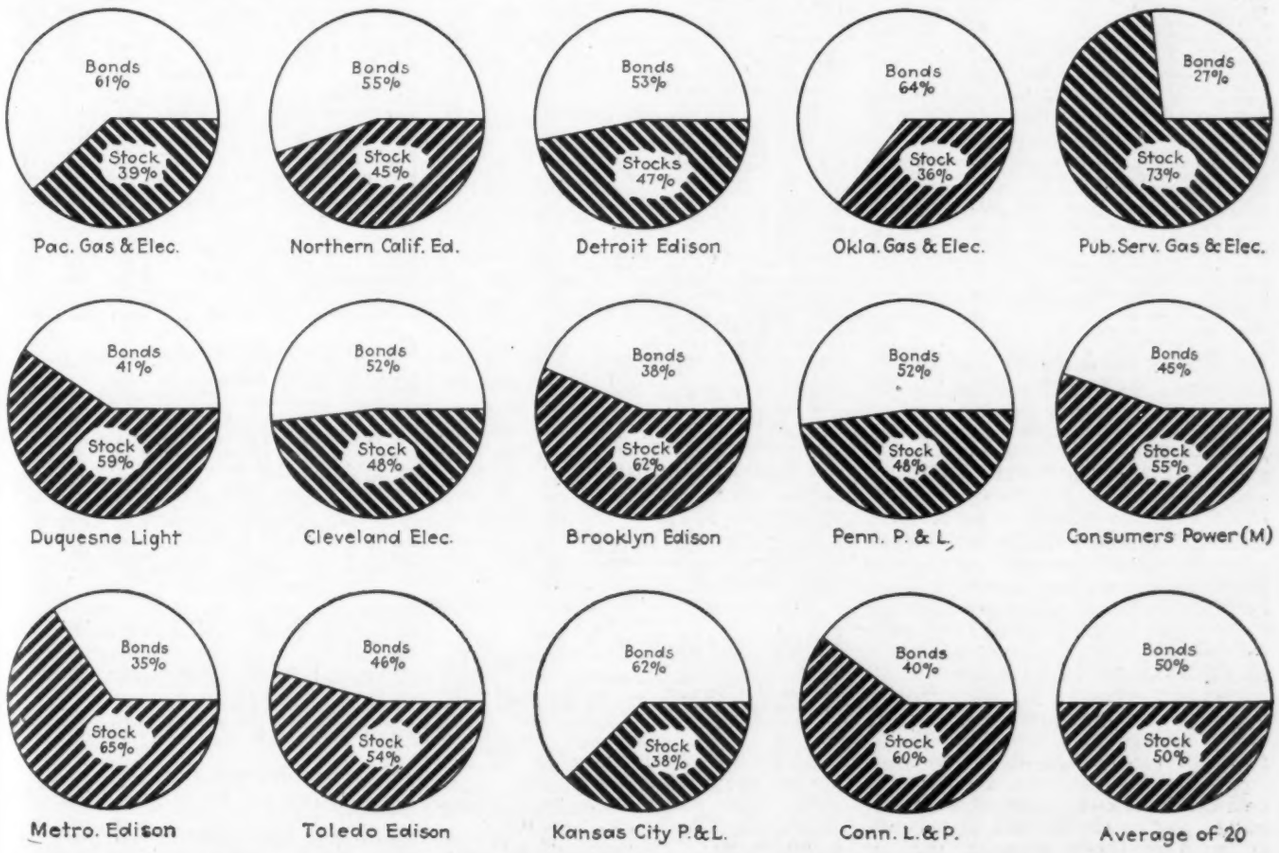
Times-Interest-Earned Ratio Questioned

Rule that Net Earnings Should Be Double Bond Interest Has Limitations—May Be Supplemented by New Ratio Emphasizing Surplus After Bond Interest

By H. M. Cameron
Financial Editor Electrical World

THAT bond interest has been earned twice or better is freqently emphasized by public utility companies in their published statements. There are those who depend implicitly upon this ratio as a gage of the company's position. There are others who are just as critical of its significance. Since the ratio is frequently a major factor in determining the price a company must pay for new money, a brief inquiry into its validity may be worth while.

A study of the capital structures of 20 representative power and light companies, disclosing as it does a remarkable lack of uniformity in the proportion of capital in the form of obligations, throws some light on the situation. Instead of an even 60 per cent or thereabout, funded debts show a range of from 37 to 64 per cent of the total. The average for the 20 companies is exactly 50 per cent. It is obvious that each individual company is and must be a law unto itself. Many New England utilities have no debts. Others which had relatively large debts have been reducing them for specific reasons. Still other companies obtain a larger proportion of their capital from the sale of bonds than is generally regarded as good practice. The diagrams shown illustrate the wide variation which exists in this respect.



Stock and Bond Distribution of Capitalization in Fourteen Representative Companies. Average of Twenty Is 50 per Cent

Such a striking variation in the volume of obligations means a corresponding variation in bond-interest requirements and hence in the number of times bond interest is earned, assuming less diversity in net earnings. In the case of a company with a financial status such as the following a more rigid test than the one under discussion may be required:

Total investment	$4,000,000
Gross revenue	1,000,000
5 per cent bonds outstanding	2,000,000
Interest thereon	100,000
Net earnings	150,000

It is apparent that if interest had been earned only one and a half times, the minimum requirement under the rule, the margin after interest would be only 5 per cent of gross revenue, or $50,000—a margin which might easily be wiped out under adverse business conditions.

Granted the limitations upon the use of the two-to-one ratio, it is worth while considering the merits of such a ratio as that suggested by Nash in "Economics of Public Utilities"—that the margin after interest but before provision for dividends, retirements or surplus should be not less than 20 per cent of gross earnings. The emphasis, obviously, has been shifted from bond interest to that margin which remains after bond interest. Superficially at least, this would seem to be the really significant item. A study of the application of the two tests to the twenty companies referred to shows a high degree of correlation. As shown in the footnote, the ratios converge when operating expenses are 60 per cent of gross.* At this point their meaning is identical, assuming a given interest rate which is the other variable factor.

To test the validity of the new rule, consider a property making the following showing:

Gross revenue	$ 2,500,000
Operating expenses	1,800,000
Net	$700,000
6 per cent bond issue	$10,000,000
Interest thereon	600,000
Margin after interest	100,000

According to the rule, this margin should be one-fifth of gross, or $500,000, which, allowing for the same interest payments, would require net earnings of $100,000. In such an instance the bond interest has been earned less than twice. The ratio is less rigid than the old two-to-one rule.

There are evidently instances in

*Formula (1)—Net = or > 2 × interest.
Formula (2)—Margin = or > ½ gross.
(g = gross; r = operating rates; n = net; i = interest; m = margin.)
(1) $g - gr$ = or > $2m$, or $g(1 - r)$ = or > $2m$.
$g \div m$ = or > $2 \div (1 - r)$.
To satisfy (2) $g \div m$ = or > 5;
$2 \div (1 - r) = 5$; $2 = 5 - 5r$;
$r = \frac{3}{5}$ or 60 per cent.

Company No. 1:

Gross	$5,000,000
Operating	3,000,000
Net	$2,000,000
Interest	1,000,000
Margin	$1,000,000

Both ratios are satisfied.

Company No. 2:

Gross	$5,000,000
Operating	3,500,000
Net	$1,500,000
Interest	750,000
Margin	$ 750,000

When operating reserve is larger, the two-to-one ratio is satisfied, but the Nash ratio is not.

Company No. 3:

Gross	$5,000,000
Operating	2,800,000
Net	$2,200,000
Interest	1,200,000
Margin	$1,000,000

Nash ratio satisfied, but other not.

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Monday Nov. 1	Low 1926	High 1926
ABITIBI PWR. & PAPER, com.	*		
—no par	93½	70½	98
Adirondack Pwr. & Lt.—7% pf.	103½	....	....
Adirondack Pwr. & Lt.—8% pf.	112	....	....
Ala. Pwr., pf.	106½	....	....
Allis-Chalmers Mfg. pf.	109	105	110½
Allis-Chalmers Mfg., com.	87	78½	94½
Aluminum Co. of Amer., com.	68	....	....
Aluminum Co. of Amer. pf.	101	....	....
Amer. & Foreign Pwr., pf. 25% pd.	m110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	83½	79	98
Amer. & Foreign Pwr., com.—no par	14½	14½	42½
Amer. Bosch Magneto, com—no par	18	16	34½
Amer. Brown, Boveri, Elec.	37½	30½	50
Amer. Brown, Boveri, Elec., pf.	96	86½	97½
Amer. Elec. pwr., —50	c47	36	59
Amer. Gas & Elec., 6% pf.—no par.	96	....	....
Amer. Gas & Elec., com.—no par.	106½	64	110½
Amer. Lt. & Trac., 6% pf.	109	105	115½
Amer. Lt. & Trac., com.	210	193	263
Amer. Pwr. & Lt., 6% pf.	97	....	....
Amer. Pwr. & Lt., com.—no par.	m 66½	50½	72
Amer. Pub. Serv., 7% pf.	a 97½	92	99
Amer. Pub. Serv., com.	50	45	80
Amer. Pub. Utilities, 6% pf.	78	....	....
Amer. Pub. Utilities, 7% pf.	90	....	....
Amer. Pub. Utilities, com.	68	....	....
Amer. States Sec., A	2½	....	....
Amer. States Sec. B	2½	....	....
Amer. Superpwr., pf.—25	k 26	23	26½
Amer. Superpower, pf.	k 95	....	....
Amer. Superpwr., Class A—no par.	k 27½	19½	37½
Amer. Superpwr., Class B—no par.	29½	21½	39
Amer. Wtr. Wks. & Elec., 7% pf.	(k103½	101½	108½
Amer. Wtr. Wks. & Elec., com.—20	53½	43½	74
Anaconda Copper	e 47½	....	....
Appalachian Elec. Pwr., 7% pf.	98	90	101
Appalachian Elec. Pwr., 2d pf., 7%	98	99	102
Appalachian Elec. Pwr., com.	78	78	83
Arizona Pwr., 7% pf.	70	....	....
Arkansas Cent. Pwr., pf., $7—no par	k101	99	107
Arkansas Lt. & Pwr., 7% pf.	102	....	....
Arkansas Lt. & Pwr., com.	100	110	115
Asheville Pwr. & Lt., 7% pf.	f107	100½	107½
Assoc. G. & E., pf.—$3.50—50	50	....	....
Assoc. Gas & Elec., pf.—$6—no par	83	....	....
Assoc. Gas & Elec., Class A—no par	35	25½	38½
BABCOCK & WILCOX, com.	114	....	....
Binghamton Lt., Ht. & Pwr., pf.	90	92	95
Birmingham Elec. pf.—$7—no par	102	100½	106
Blackstone Valley Gas & Elec., pf.	103	103	106
Blackstone Valley G.&E., com.—50	k102	100½	106
Blaw-Knox, com.	f 74½	....	....
Brazilian Trac., Lt. & Pwr., com.	f106½	....	....
Broad River Pwr., pf.	94	....	....
Brooklyn Edison, com.	156½	133	163
Buffalo, Niagara & East Pwr., pf.—25	f 25	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par	f 31	....	....
CALIFORNIA ELEC. GENERATING, pf.	93	89	95
California Ry. & Pwr., pf.	120	88	130
Carolina Pwr. & Lt., pf.—$7—no par	107	....	....
Cent. & S. W. Ut. 7% pf.—no par	a 93	89½	96½
Cent. & S. W. Ut., pr. ln. pf.—no par	a 99	93	100
Central Ariz. Lt. & Pwr., pf.	104	....	....
Central Ark. Ry. & Lt., 7% pf.	100	....	....
Central Ill. Pub. Serv., 6% pf.	a 88½	87	91
Central Ind. Pwr., 7% pf.	a 87½	85	93
Central Pwr. & Lt., pf.	99	....	....
Central States Elec., 7% pf.	91	....	....
Central States Elec., com.	m200	200	230
Century Elec., com.	m117	110	117
Chicago Fuse Mfg., com., no par.	m 32	30	35
Cincinnati Gas & Elec., com.	g 92½	....	....
Cities Service, 6% pf.	f 91½	86½	91½
Cities Service, pf. B—10.	f 8½	7½	8½
Cities Service, pf. BB—100.	f 82½	74	82½
Cities Service, com.—20.	f 48½	37½	48½
Cities Service, Bks. Shrs.—10.	f 24	19½	24
Clarion River Pwr., pf.	95	93	95
Cleveland Elec. Illg., 6% pf.	107½	....	....
Cleveland Elec. Illg., com.	295	....	....
Colorado Pwr., 7% pf.	k 95	96	97
Columbia Gas & Elec., 7% pf.	113½	111½	115½
Columbia Gas & E., com.—no par.	86½	63½	90
Columbia Ry., Gas & Elec., 6% pf.	90	65	96
Columbus Elec. & Pwr., 2d pf.	104½	....	....
Columbus Elec. & Pwr., com.	240	....	....
Columbus Ry., Pwr. & Lt., 1st pf.	99	....	....
Columbus Ry., Pwr. & Lt., pf. B.	93½	....	....
Col. Ry., Pwr. & Lt., com.—no par.	69½	....	....
Commonwealth Edison, com.	a137	135½	145
Commonwealth Pwr., 6% pf.	k89	82	89
Commonwealth Pwr., com—no par.	39½	28½	48½
Conn. Lt. & Pwr., 8% pf.	117	....	....
Conn. Lt. & Pwr., 7% pf.	108	....	....
Cons. Gas of N. Y., pf.—50.	58½	....	....
Cons. Gas of N.Y., com.—no par	106½	87	115½
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	k104	102	105
Cons. Gas, Elec. Lt. & Pwr. of Balti. 6½% pf.	e110½	....	....
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	e113½	109	113½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	e126½	124	128½
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par	e 51½	45	57½
Cons. Pwr. & Lt., 7% pf.	105	....	....
Consumers Pwr., 6% pf.	98	....	....
Consumers Pwr., 6.6% pf.	104	....	....
Continental Gas & Elec., 7% pfc. pf	102	....	....
Continental Gas & Elec., 7% pr. pf.	97½	....	....
Continental G.&E., com.—no par.	180	....	....
Crocker Wheeler, com.	21	....	....
Crocker Wheeler, pf.	57	....	....
DALLAS PWR. & LT., 7% pf.	107½	....	....
Dayton Pwr. & Lt., 6% pf.	100	....	....
Detroit Edison, com.	135	123½	141½
Dubilier Condenser com.—no par.	3½	3½	11
Dubuque Elec., 6% pf.	94	93	98½
Duquesne Lt., 7% pf.	d115½	112	116
EAST. N. Y. UTIL. pf.	101	100½	104½
Eastern New York Util., com.	65	70	75
Eastern States Power.	12½	....	....
Eastern States Power, pf.	89	....	....
Eastern Tex. Elec., 7% pf.	105	....	....
East. Tex. Elec., com.—no par.	75	70	80
Edison Elec. Illum. of Boston, com.	d220	....	....
E. Paso Elec., com.—no par.	70	70	94
E. Paso Elec. pf.	103	....	....
Elec. Bond & Share, 6% pf.	h106	103½	109½
E. Bd. & Share Sec., com.—no par.	i 68	56½	86
El. Household Util.	a 12	11½	25
Elec. Investors, 6% pf.—no par.	93	....	....
Elec. Investors, com.—no par.	38	30½	74½
Elec. Investors, 10% pd. receipts.	25	12	56
Elec. Pwr. & Lt., ctfs, pf.	94½	89½	98½
Elec. Pwr. & Lt., ctfs., 40% pd.	k101½	99½	115
Elec. Pwr. & Lt., ctfs. full pd.	k101½	102½	110½
Elec. Pwr. & Lt., ctfs., com—no par.	15½	15½	34½
Elec. Refrig.	46	43½	78½
Elec. Ry. Securities, com.—no par.	m 5½	4½	10
Elec. Storage Battery, com.—no par.	k84	71½	94½
Elmira Wtr., Lt. & R. R., 7% pf.	98	97½	99½
Emerson Elec., pf.	m101	100	104½
Empire Dist. Elec., 6% pf.	f 90	82	90
Empire Power, A	26½	21	32
Engr. Pub. Serv., pf.—no par.	93	93	96½
Engr. Pub. Serv., com.—no par.	19½	19½	24½
Eureka Vac. Cleaner, com.—no par.	52	43	56
FAIRBANKS MORSE, pf.	k108	106½	110½
Fairbanks Morse, com.—no par.	43½	40½	59½
Federal Lt. & Trac., com.	k 33	28	39½
Federal Light & Traction, pf.	k 87½	86	91½
Federal Utilities, pf.	m 70	....	....
Federal Utilities, com.	m 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	f107½	105	108½
GALVESTON-HOUSTON ELEC., 6% pf.	60	....	....
Galveston-Hstn. El., com.	21	....	....
Gen. Elec., com.	82½	79	95½
Gen. Elec., special—10.	11½	11	11½
Gen. G.&E., (Del.) com. A no par.	39½	34	59
Gen. G.&E., (Del.) com. B no par.	m 38½	38½	48½
Gen. G.&E., (Del.) A pf. $8 no par.	k111	105½	113
Gen. G.&E., (Del.) A pf. $7 no par.	k 98	95	99½
Gen. G.&E., (Del.) pf. B.	k 94½	92½	96
General Public Service, pf.	m103	100	106
General Public Service, com.	k 11½	11½	16½
Ga. Lt., Pwr., & Rys., 6% pf.	m 90	82	98
Ga. Lt., Pwr. & Rys., com.	m 70	65	80
Ga. Ry. & Power, 8% pf.	k114	112	114
Ga. Ry. & Power, 7% pf.	106½	....	....
Ga. Ry. & Pwr., 4% pf.	m120	105	145
Ga. Ry. & Pwr., com.	120	....	....
Gt. Western Pwr., 7% pf.	h102	....	....
IDAHO PWR., 7% pf.	103	....	....
Ill. No. Utilities, 6% pf.	a 91½	90	92½
Ill. Pwr. & Lt., 7% pf.	98	....	....
Ingersoll Rand.	k 96½	80½	104
Int. Combus. Engr., com.—no par	40½	33½	64½
Int. Utilities, class A—no par.	k 30	25	39
Int. Utilities, class B—no par.	4½	3½	9½
Interstate Pwr., pf., no par.	92	....	....
Interstate Pub. Serv., 7% pf.	97½	96½	99
Iowa Ry. & Lt., 7% pf.	95	98	100
JERSEY CENTRAL PWR. & LT., 7% pf.	96	....	....
Jersey Central Pwr. & Lt., ptc., pf.	108	95½	112
Jersey Central Pwr. & Lt., com.—no par	k 25	25	50
Johns-Manville, com.—no par.	151	130	165

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high. Saturday, Oct. 30. lBid, low, high, Wednesday, Nov. 3. mLatest quotations available.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Monday Nov. 1	Low 1926	High 1926
KANSAS CITY PWR. & LT., pf.	*k*112	107½	113
Kansas Gas & Elec., 7% pf. ex. div.	*l*103½	99	103½
Kentucky Hydro-Elec., pf.	*a* 93½	91½	95½
Kentucky Sec., 6% pf.	80	....	....
Kentucky Sec., com.	101	....	....
Kentucky Utilities, 6% pf.	94	90	95
Keystone Pwr. & Lt. 7% pf.	96	95	97
LA CLEDE GAS LT., com.	*k*162	146	175½
Lehigh Pwr. Sec., com.—no par	14½	10	22
Long Island Ltg., 7% pf.	108½	....	....
Long Island Ltg., com.—no par	130	120	150
Los Angeles Gas & Elec., 6% pf.	98	....	....
Louisville Gas & Elec., Class. A	*k* 23½	22½	26½
MANHATTAN ELEC. SUPPLY.	51	44	87½
Manila Elec., com.—no par	*k* 38	27½	45½
Maytag Mfg., com.	23½	19	24½
Memphis Pwr. & Lt., pf., $7, no par	108	....	....
Metro. Edison, pf.—$6—no par	93½	....	....
Metropolitan Edison, pf., $7, no par.	104½	....	....
Metropolitan Edison, com., no par.	55	45	55
Middle West Utilities, 7% pf.	*a*104½	97½	111½
Middle West Utilities, 7% pr. lien pf.	*a*115	106½	123½
Middle West Utilities, com.—no par.	*a*110½	....	....
Midland Utilities, pr. ln. pf.	*a* 99½	98	104
Midland Utilities pf. A	*a* 97	96	99½
Milwaukee Elec. Ry. & Lt., 7% pf.	98	100	102
Milwaukee Elec. Ry. & Lt., 6% pf.	91	87	88½
Minn. Pwr. & Lt., 7% pf.	*l*104½	100	104½
Miss. Pwr. & Lt., pf.	106	....	....
Miss. River Pwr., 6% pf.	95	....	....
Miss. River Pwr., com.	60	....	....
Mohawk Hudson Pwr., 1st pf.—$7 no par	101½	....	....
Mohawk Hudson Pwr., 2nd pf.—$7—no par	98	....	....
Mohawk Hudson Pwr., com.—no par	23½	20½	28½
Montana Pwr., pf.	*m*117½	112½	119½
Montana Pwr., com.	79	69½	83½
Montreal Pwr., com.	*f* 74½	....	....
Mountain States Pwr. pf.	96	....	....
Mountain States Pwr., com.	18	....	....
NASSAU & SUFFLOK, LTG., pf.	100	....	....
National Carbon, pf.	*a*124	124	128
National Electric Pwr-A	*a* 21½	....	....
National Elec. Pwr., pf.	*a*93½	92	96½
Nat. Lt., Ht. & Pwr., com.	24	22	25
National Lt., Ht. & Pwr., 5% pf.	72	71	73
National Pwr. & Lt., pf., $7—no par.	101½	96	102½
National Pwr. & Lt., com.—no par.	19½	16½	38½
National Pub. Serv., 7% pf.	89	....	....
National Pub. Serv., pte. pf.	109	....	....
National Pub. Serv., A com.—no par.	*k* 18½	15½	24
National Pub. Serv., B com.—no par.	*k* 13½	10	16½
Nebraska Pwr., 7% pf.	*l*108	103	107½
Nevada-Calif., Elec., com.	*k* 20	18½	44½
New Brunswick Pwr., pf.	55	30	55
New England Pub. Serv., pr. ln. pf.	99½	98	99½
New England Pub. Serv., pf.	*k* 92	95½	97
N. J. Pwr. & Lt., 7% pf.	109½	104	110
New Orleans Pub. Serv., 7% pf.	103	....	....
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	89	....	....
N. Y. Central Elec., 7% pf.	98½	98	100
Newport News & Hampton Ry., Gas & Elec., com.	109	98	112
Newport News & Hampton Ry., Gas & Elec., pf.	109	98	114
Niagara Falls Pwr., 7% pf.—25	*ck* 28½	27½	28½
Niagara, Lock. & Ont. Pwr., 7% pf.	109	110	111½
No. Amer., 6% pf.—50	50½	49	52½
No. Amer., com.—10	48½	42	67
No. Amer. Edison pf.—no par	*k* 96½	91½	96½
No. Amer. Lt. & Pwr., pf.	101	88	104
No. American Utilities, pf., full pd.	*m* 94½	89	96
No. American Utilities, pf., 25% pd.	*m* 19	18	27
N.C. Pub. Serv., pf.—$7—no par	93	....	....
Northeastern Pwr., com.	18	15½	36½
No. Indiana Gas & Elec., pf. A	101	98	103½
No. Indiana Public Service—pf.	101	....	....
No. N. Y. Utilities, 7% pf.	103	....	....
No. Ohio Pwr., com.—no par	13½	11	26½
No. Ohio Trac. & Lt., 6% pf.	78	78	81
No. Ohio Trac. & Lt., 7% pf.	92	88	96
No. Ont. Lt. & Pwr., pf.	83	....	....
No. Ont. Lt. & Pwr., com.	73	45	75
No. States Pwr., 7% pf.	102	....	....
No. States Pwr. com.	105½	97	136½
No. Texas Elec., 6% pf.	62	....	....
No Texas Elec., com.	19	....	....
OHIO BRASS, com. B—no par	72	70	79
Ohio Brass, pf.	100	98	101
Ohio Gas & Elec., 7% pf.	94	92	95
Ohio Pwr., 6% pf.	95½	93	96
Ohio Pub. Serv., 6% pf.	*l* 94½	90	96½
Ohio Pub. Serv., 7% pf.	*l*102½	96	102½
Ohio River Edison, pf.	100½	....	....
Oklahoma Gas & Elec., pf.	96	....	....
PACIFIC GAS & ELEC., 6% pf.	100	99	103
Pacific Gas & Elec. com.	*h*128½	118	134
Pacific Pwr. & Lt., 7% pf.	*l*102½	98	102½
Parr Shoals Pwr., 6% pf.	92	....	....
Penn Central Lt & Pwr., pf.—no par	*c* 72	70½	91
Penn-Ohio Edison, 7% pf.	96	....	....
Penn-Ohio Elec., 7% pf.	95	93	96
Penn-Ohio Pwr. & Lt., 7% pf.	98	....	....
Penn-Ohio Pwr., & Lt., 8% pf.	106	100	109
Penn Pwr. & Lt.—$7—no par.	*l*106½	103	108½
Penn Pub. Serv., 7% pf.	103	96	103
Penn Pub. Serv., 6% pf.	87	85	90
Penn Wtr. & Pwr., com.	*e*160	141	171
Phila. Co., 6% pf.—50	*c* 48½	....	....
Phila. Co., com.—50	*c* 72½	66½	76½
Phila. Elec., com.—25	*c* 49½	....	....
Pittsburgh Utilities, pf.—10	*m* 19½	14½	20½
Portland Elec. Pwr., 7% pf.	97	....	....
Portland Elec. Pwr., 6% pf.	83	....	....
Portland Elec. Pwr., 6% 2nd pf.	71	....	....
Portland Elec. Pwr., com.	27	....	....
Potomac Elec. Pwr., pf.	*l*108	....	....
Pwr. Corp. of N.Y., com.—no par.	*m* 79	77½	90½
Pwr. Sec., pf.—no par.	*k* 24	10	29
Pwr. Sec., com.—no par	*k* 6	4	13
Pub. Serv. of Colorado 7% pf.	*l* 99	96	100
Pub. Serv. of N. J., 7% pf.	109	103½	109½
Pub. Serv. of N. J., 8% pf.	124	115	124
Pub. Serv. of N. J., com.—no par.	96	72	97½
Pub. Serv of N. J., new com.	32½	31½	32½
Pub. Serv. of No. Ill., 6% pf.	*k*101	101	103
Public Serv. of No. Ill., 7% pf.	*a*113	106	114
Pub. Serv. of No. Ill., com.—no par	*a*129	127	140
Pub. Serv. of No. Ill., com.	*k*130½	126	135
Pub. Serv. of Okla., 7% pf.	98	92	97
Pub. Serv. Elec. & Gas, 6% pf.	*k*103	97	104½
Public Service Elec. Pwr., pf.	*k*113½	106	114
Puget Sound Pwr. & Lt., 7% pf.	102½	....	....
Puget Sound Pwr. & Lt., 6% pf.	83½	....	....
Puget Sound Pwr., & Lt., com.	26	....	....
RADIO CORP. OF AM., pf.—50	49½	44½	50
Radio Corp. of Amer., com.—no par.	56½	32	60½
Republic Ry. & Lt., pf.	110	....	....
Republic Ry. & Lt., com.	93	....	....
Rochester Gas & Elec., 5% pf.	*m* 95	80	98
Rochester Gas & Elec., 6% pf.	102	100	103
Rochester Gas & Elec., 7% pf.	105	....	....
SAN JOAQUIN LT. & PWR., 7% pf.	97	97½	98½
Safety Cable, com.	50½	42½	55
St. Joseph Ry., Lt., Ht. & Pwr., pf.	67	60	70
Servel Corp.	14½	12½	22½
Sierra Pacific Elec., com.	23	....	....
Sioux City Gas & Elec., 7% pf.	*l* 98½	....	....
S. E. Pwr. & Lt., pf.—$7—no par.	100	....	....
Southeastern Pwr. & Lt., pfc. pf.	66½	....	....
S. E. Pwr. & Lt., com.—no par.	29½	20	46½
So. Calif. Edison, 8% pf.—25	30	32½	33½
So. Calif. Edison, 7% pf.—25	*l* 27½	....	....
So. Calif. Edison, 6% pf.—25	24	....	....
So. Calif. Edison, com.	30½	30½	33
Southern Cities Utilities, 7% pf.	85	....	....
Southern Cities Utilities, com.	34	....	....
Southwestern Lt. & Pwr., A	60	....	....
Southwestern Lt. & Pwr., B	60	....	....
Southwestern Lt. & Pwr., $6 pf.	82	....	....
Southwestern Pwr. & Lt., 7% pf.	*k*104	100	105
Springfield (Mo.) Ry & Lt., 7% pf.	97	95	100
Standard Gas & Elec., 8% pf.	56½	53½	57½
Standard Gas & Elec., 7% pf.	101	....	....
Standard Gas & Elec., com.—no par.	53½	51	69
Standard Pwr. & Lt., 7% pf.	95½	....	....
Staten Island Edison, pf.—$6—no par	95	....	....
Superheater, com.—no par.	150	....	....
Syracuse Lighting, 7% pf.	102	105	107
Syracuse Lighting, 8% pf.	115	....	....
Syracuse Lighting, com	340	260	355
TAMPA ELEC., com.	46½	....	....
Tenn. Elec. Pwr., 6% pf.	90	....	....
Tenn. Elec. Pwr., 7% pf.	103	....	....
Terre Haute, Ind. & East Trac., pf.	20	20	37
Terre Haute, Ind. & East. Trac., com	1	1	7
Tex. Pwr. & Lt., 7% pf.	*l*107½	102	107½
Tide Water Pwr., 8% pf.	104	....	....
Timken Roller Bearing, com—no par	79½	44½	85
Toledo Edison, 8% pf.	*l*113	111	113
Toledo Edison, 7% pf.	*l*103	101	103
Toledo Edison, 6% pf.	*l* 94½	90	95
Toledo Edison, com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	88	87½	89
UNITED GAS & ELEC., 6% pf.	98	....	....
United Gas & Elec., com.—no par.	*m* 57	56	66
United Gas & Elec. (N.J.), 5% pf.	70	....	....
United Gas Impr.—50	*e*107	84½	144½
United Lt. & Pwr. pf.—$4—no par.	*a* 50	42½	54
United L. & P. pf.—$6.50—no par.	87	85	88½
United Lt. & Pwr., com., A—no par	*a* 12½	11	26
United Lt. & Pwr., com., B—no par	*a* 17	15	31
Utah Pwr. & Lt., 7% pf.	*l*103½	99	103½
Utica Gas & Elec., 7% pf.	105	....	....
Utica Gas & Elec., com.	200	....	....
Utilities Pwr., & Lt., 7% pf.	92	....	....
Utilities Pwr. & Lt., com A	30	28½	37
Utilities Pwr. & Lt., com. B—no par	*k* 14½	13½	18
VERMONT HYDRO - ELEC., 7% pf.	95½	94	96
Virginia Elec. & Pwr., 7% pf.	104	104	105½
Virginia Pwr., 7% pf.	108	102	104
Virginian Pwr., com.	70	65	75
WAGNER ELEC., pf.	*b* 70	61½	85
Wagner Elec., com.—no par.	*b* 20	13½	34½
Washington Ry. & Elec., com.	*f*170	....	....
Washington Ry. & Elec., pf.	*f* 90½	....	....
Washington Wtr. Pwr., com.	132	130	136
West Mo. Pwr., 7% pf.	*m* 92	....	....
West Penn., 7% pf.	113½	108	115
West Penn, com.	*m*125½	118	130
West Penn Elec., pf.	*k* 99	95½	101
West Penn Elec., Class A,	*k* 98½	88½	98½
West Penn Pwr., 6% pf.	*k*113½	108	115
West Va. Lt., Ht. & Pwr., 7% pf.	94½	95	98
West Va. Util ities, 7% pf.—50	47	43	48
Western Pwr., 7% pf.	97½	....	....
Western States Gas & Elec., 7% pf.	93	....	....
Western States Gas & Elec., com.	17	....	....
Westinghouse El. & Mfg., com—50	67½	65	79½
Weston Elec. Instrument, Class A	32½	27½	32½
Weston Elec. Instrument, com.	17½	13½	19½
Wheeling Elec., pf.	95	92	96
Wis. Pwr., Lt. & Ht., 7% pf	*k* 90	85	90
Worthington Pump, pf. A	51	51	80
Worthington Pump, pf. B	43	41½	65
Worthington Pump, com	22	19½	44½
YADKIN RIVER PWR., 7% pf.	*l*107	102	107½
Yale & Towne, com.—25	70	60½	72½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high, Saturday, Oct. 30. *l*Bid, low, high, Wednesday, Nov. 3. *m*Latest quotations available.

which the old rule is applicable and not the new, and vice versa. As indicated by the footnote, the two are complementary and should be used as a check upon each other.

Financial Set-Up Proposed for New Company in Indianapolis.—The petition filed with the Indiana Public Service Commission asking that the Indianapolis Light & Heat Company and the Merchants' Heat & Light Company, competing companies in Indianapolis, be merged contained the details of the financial structure of the new company. The Indianapolis Light & Heat Company has outstanding bonds in the sum of $3,782,000 and the Merchants' company in the sum of $8,989,000. The new company purposes to acquire or pay off these bonds. The estimated value of the properties, assets and franchises of both companies is $38,679,000, the petition says, and in addition the new company will require a working capital of $1,000,000. The total of these amounts is $52,450,000. To meet this cost the petition proposes for the company the following financial structure: Five per cent 30-year first mortgage gold bonds, $32,000,000, to be sold at not less than 93; 6½ per cent preferred stock, 140,000 shares, par value $100 a share, to be sold at not less than $92; common stock, 981,000 shares, no par value, to be sold at not less than $10.

Substantial Amount of International Paper Debentures Sold.—Convertible gold debentures of the International Paper Company to the amount of $25,000,000 have been sold at 98 and interest to yield over 6 20 per cent. These debentures were dated Oct. 1, 1926, and mature Oct. 1, 1941. Proceeds from the sale of this issue will be used for the company's development program.

American & Foreign Power to Acquire Havana Utility

Directors of the American & Foreign Power Company, Inc., have arranged on behalf of the company to acquire from the Electric Bond & Share Company all of its holdings in the Havana Electric & Utilities Company, which controls the Havana Electric Railway, Light & Power Company. If the stockholders confirm the action of the directors, the Electric Bond & Share Company will receive as full payment for its holdings of securities in the Havana company and as compensation for its overhead costs and its risks (a) either 20-year 6 per cent debentures of the American & Foreign Power Company or 20-year 6 per cent debentures of a Cuban subsidiary, equal in principal amount to the actual costs incurred by Electric Bond & Share Company to date of payment, excluding overhead

costs but including interest at the rate of 6 per cent per annum; and (b) 300,000 shares of common stock of American & Foreign Power Company, Inc.

At the meeting to be held Nov. 12 stockholders will also vote on increasing the authorized common stock (no par value) from 1,500,000 shares to 1,800,000 shares.

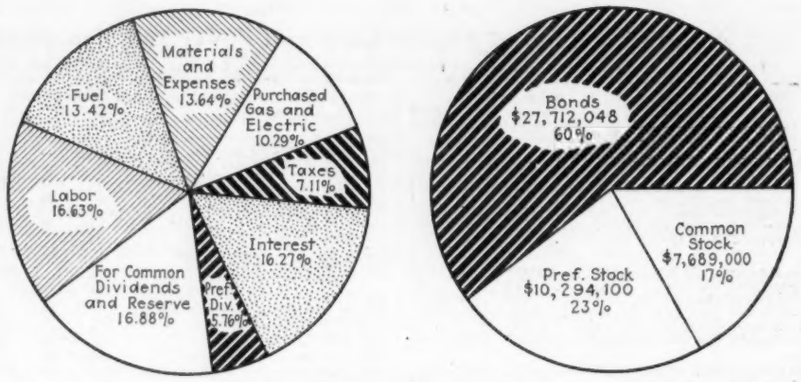
Ohio Public Service Earnings Up

Rise of 14 per Cent in 1925—Adequate Margin Is Left After Payment of Bond Interest

A RISE of 14 per cent in net earnings against a gross revenue increase of 7½ per cent at the end of 1925 records an improvement in the affairs of the Ohio Public Service Company. Unfortunately, no information has been received on the company's standing since that date.

This increase in revenue is due largely to increased business rather than merely to the addition of properties. The gross operating and non-operating revenue was $11,315,432, which, after deducting all operating expenses including taxes, left $4,387,037, or two and one-half times bond interest. The margin after payment of interest, but before making provision for dividends, retirement and surplus, is slightly more than 20 per cent of gross. This is considered a very good margin for companies of this type. No statement is made of provision for depreciation.

It is interesting to note the distribution of the company's gross revenue for the past year. Labor cost requires 16.63 per cent, which is lower than the proportion required in most lines of business. The tax bill is 7.1 per cent, which is higher than the proportion charged upon industry generally, being approximately 43 per cent of the amount of the company's total payroll. The total tax bill was approximately one and a quarter times preferred dividends paid. Interest requirements amounted to about one-sixth of the revenue total. Preferred dividends were 5.7 per cent of revenue, and 16.88 per cent was left for common dividends and reserves after payment of purchased electricity, gas, fuel and other material.



DIVISION OF THE REVENUE AND CAPITALIZATION OF OHIO PUBLIC SERVICE COMPANY

The company's capital structure is made up thus:

Preferred stock	$10,294,100
Common stock	7,689,000
Total	$17,983,100
Funded debt:	
Underlying bonds	$4,165,500
First mortgage bonds	23,525,000
First certificate	21,548
Total funded debt	$27,712,048

Thus out of the total capitalization of $45,695,148, the indebtedness accounts for approximately 61 per cent, preferred 22 per cent and common 17 per cent. The total capitalization is approximately four times gross revenue. The total value of plant and investment as determined by the Public Utilities Commission of Ohio amounts to $46,928,136, which is approximately four times gross revenue.

Utility Financing in October Active

In October new electric light and power public utility financing showed a marked recovery following the slump in September. New flotations of this type of security aggregated $61,243,500, as compared with $10,985,000, the amount recorded for September, and $49,759,000 for August. The total, however, failed to reach that of October a year ago by approximately $6,000,000. Several sizable issues appeared, the largest having been offered by the Cleveland Electric Illuminating Company in the form of general mortgage gold bonds totaling $10,000,000.

Long-term financing predominated as usual. The rate of return yielded the investor advanced to the 5.50 per cent mark from 5.27 per cent in September.

Security Issues of Electric Service Companies in October

Name of Company	Amount of Issue	Period Years	Class	Purpose	Interest Rate		Per Cent Yield
Cleveland Electric Illuminating Co..	$10,000,000	35	General mortgage gold bonds, series B	To reimburse for expenditures already made for betterments and extensions	5	102½	4.85
Gulf States Utilities Co.	9 000,000	30	First mortgage and refunding gold bonds	Retirement of debt, construction and for other corporate purposes	5	96	5.25
Standard Gas & Electric Co.	7,500,000	25	Gold debentures	To reimburse for expenditures made in the acquisition of public utility securities and for other corporate purposes	6	99	6.08
Commonwealth Light & Power Co..	2,000,000	1	Secured gold notes		6	100	6
Tide Water Power Co.	1,500,000	..	Preferred stock	Acquisition of new properties, redemption of bonds, and for construction	7	97½	7.17
	2,500,000	20	General lien gold bonds	Acquisition of new properties, redemption of bonds, and for construction	6	98½	6.13
Kentucky Utilities Co.	6,250,000	35	First mortgage gold bonds	Refunding for extensions, improvements, additions and for other corporate purposes	5	97	5.20
Eastern Oregon Light & Power Co..	225,000	25	Refunding and first collateral mortgage gold bonds, series A		5½	100	5.50
Colonial Gas & Electric Co.	2,000,000	3	Secured gold notes	Acquisition of new stock and for other corporate purposes	5½	98½	6.05
Federal Light & Traction Co.	1,329,000	16	First lien gold bonds	To reimburse treasury for capital expenditures already made and for other corporate purposes	5	95½	5.40
Public Service Co. of New Hampshire	3,239,500	..	Preferred stock	To retire capital obligations of companies merging to form Public Service Company, to reimburse for additions completed and now under construction	6	95	6.32
Suburban Light & Power Co.	500,000	..	Cumulative first preferred stock	To reimburse for cost of additions to present properties and for other corporate purposes	7	95	7.37
Alabama Power Co.	6,000,000	30	First mortgage lien and refunding gold bonds		5	98½	5.10
Central Maine Power Co.	3,000,000	29	First and general mortgage gold bonds, series D	To retire bonds	5	100	5
Queens Borough Gas & Electric Co.	1,500,000	29	Refunding mortgage gold bonds	To reimburse for additions, extensions and improvements	5	99⅓	5.03
Texas Power Corp.	1,600,000	30	First mortgage gold bonds	Construction	6	99	6.07
Electrical Securities Corp.	1,000,000	30	Collateral trust sinking fund gold bonds		5	98½	5.10
People's Light & Power Corp.	2,100,000	15	First lien gold bonds	Construction	5½	95½	5.95
Total	$61,243,500						

Manufacturing and Markets

How Foreign Nations Fix American Prices

More than 30 Raw Materials Now Imported May Be Controlled in Price by Other Governments—History of Development and Remedies Suggested

IN 1922 the federal Department of Commerce first called public attention to the growth of foreign government controls of price and distribution of our imported raw materials as likely to develop great dangers to the American consumer. In March, 1923, Congress directed the department to investigate and report upon the subject. Exhaustive investigations were made in the areas of production and the reports of findings have been published in various brochures during the years 1924, 1925 and 1926. There are at present governmentally controlled foreign combinations in nine raw materials—long-staple cotton, camphor, coffee, iodine, nitrates, potash, mercury, rubber and sisal. Our imports of these materials during the fiscal year amounted to $1,031,555,097. There are some other virtual monopolies indirectly supported by benevolent policies of the interested governments rather than by direct and constant price control.

Some of these controlled commodities are of small dimensions, others of vast importance, but the very number of these controls indicates a trend. There are some 20 or 30 other commodities in the world for which we are at present dependent on import and which could likewise be controlled by action of one government or by agreement between two governments. In fact, it is possible thus to control a very large portion of the raw materials which we do not ourselves produce. Unless some deterrent arises, the enormous profits of some of the controls already in operation will not only stimulate unreasonable prices for other controlled products but will serve to encourage attempts upon other commodities. It is the belief of the department that this development will be retarded by the demonstration of practicable defense action in the case of rubber during the last fiscal year.

The object of these controls is universally asserted to be to stabilize prices to both producers and consumers at fair rates, and we would probably not be considering the question today if all these combinations had been content with fair returns, no matter how much we might object to them as fundamentally a restraint of industrial progress.

The economic objection to these controls is the stifling of production through forced restriction combined with price fixing, which entirely deflects the producer's objective from decreasing costs of production, under competitive pressure to arbitrary high prices. Thus there is a suspension of the fundamental progress of industry which can come only in increased volume of consumption and decreased costs of production. The high prices artificially imposed stifle consumption, lead to use of inferior substitutes, stimulate production in areas of inferior economic adaptation and higher costs, and thus place the commodity on an entirely fictitious basis of both production and consumption. Furthermore, in most cases the controls have resulted in periodic speculative operations by which large sums are abstracted from industry and consumers without any service rendered. Every manufacturer and distributor of these raw materials must carry large quantities in transit and in stock for his operations. His investment in materials becomes so great at these artificial price levels that if he is to be subjected to changing policies, with any ill wind or any shift in the views of governmental officials, then the whole of the savings invested in his business is in constant peril.

PUBLIC RELATIONS AFFECTED

The public relations resulting from governmental controls are even more objectionable than the economic losses. Our consumers, instead of trading with fellow merchants in the open market, bargaining with their respective views of supply and demand, find themselves confronted by governments whose whole course is in disregard of the economics of production and trade, and whose policies are often enough determined by matters entirely foreign to the industry. No industrial consumer of these commodities can rely upon his own judgment as to the conduct of his business when the policies of government officials in some foreign land dictate his destinies.

The result has been, and always will be, that the just complaint of consumers drags our government into relations which should be left to the higgling of the market. This injection of the government inevitably results in the arousing of national feeling. It may safely be said that if governments were not involved and the prices rose equally high, there would be no national feeling aroused, because under such conditions the consumer realizes that high prices are stimulating production and that relief is sure to come; but with governmentally restricted production these forces do not operate or operate but feebly and slowly. It is equally safe to say that if the conduct of industry is left in the hands of private individuals, they will not cut the throats of their consumers.

There is a world of difference in economic and international relations where industries, on one hand, acting under private initiative, restrict production to cure temporary gross overproduction, and, on the other hand, where governments restrict production for the purpose of fixing unreasonable prices. The former carries no implications of lessened effort to reduce costs, no stifling or hardship on the consumer, no price fixing, and no implications of international friction or governmental interference in the normal policies of trade. The governmental action in rubber advanced the price of a commodity costing 13 to 18 cents a pound to produce to a price of as high as $1.21 per pound. If cotton be restricted until the price ascends to $1.21 per pound, or even to 40 cents a pound, where rubber now is, the consumers of the world would complain far more bitterly than the American rubber consumers.

Each and every one of these objections to such controls has been demonstarted as valid by actual experience. Decreased consumption, substitutions, stimulation to uneconomic production, great losses to industry and consumer, international friction have been the only real products of these governmental controls, except extravagant profits to a few producers and speculators.

As has been said, if these governmental controls had been content with moderate profits, it is improbable that the question would have had other than academic interest. But the action of the rubber control in artificial advancement of prices to uneconomic levels, and the attempt of other controls to borrow money in the American market with which to strengthen their position against the American consumer, brought these matters to a crisis in demands from the American manufacturers and public consumers for action by our government. An investigation by the committee on interstate and foreign commerce of the House of Representatives in January, 1926, resulted in a unanimous report entirely confirming the views of the department.

During discussions concerning these controls various measures for protection of our consumers were put forward from different quarters. It was suggested that these controls are inevitable and that we as a government should bargain with them for the establishment of fair prices. This would probably involve our government in guaranties to buy the commodities at some certain price, and, even were this avoided, it would make our State Department a bargainer in the commodity market and would add a thousand frictions to all those which it is the business of our government agencies to allay. It was suggested that our industries should themselves collectively bargain to establish fair prices. This raised the question as to whether we wish these controls to become fixed in international life. Such a plan also

*An abstract of article by E. G. Holt in forthcoming Annual Report of the U. S. Department of Commerce.

would probably involve government supervision of these bargains. Alternatively, it was suggested that our government might set up such combinations in our own country over materials which we control either singly or jointly with one or two other major producers, thus getting our share of the profits in this game. Not only would any such policy involve us in countless frictions in international relations, but we would be doing injustice to other consuming countries.

The State Department has been opposed to all these suggestions as of the nature of offensive trade war or retaliation, and has recommended that relief should be sought in cases of unreasonable prices by the organizing of purely defensive measures, such as (a) conservation in the use so as to meet the artificially decreased production and high prices by decreased consumption; (b) stimulation of production in countries not parties to the control; (c) synthetic production at home and the development of our own resources as in the case of chemicals; (d) voluntary co-operation of our bankers to prevent the financing of these controls with American capital against the American consumer.

Trade Commission Explains Copper Export Association

The long-expected action of the copper producers in forming an export association under the Webb-Pomerene law was taken Oct. 13. This was announced in the Oct. 16 issue of the ELECTRICAL WORLD. Following the filing of the necessary papers, the Federal Trade Commission gave out this statement:

"The Copper Exporters, Inc., 25 Broadway, New York City, has filed papers under the export trade act (Webb-Pomerene law) with the Federal Trade Commission for the purpose of exporting copper and copper products.

The officers and directors of the corporation are: C. F. Kelley, president and director; F. H. Brownell, first vice-president and director; J. Clendenin, executive vice-president; L. Vogelstein, T. Wolfson, C. A. Austin and H. M. Brush, vice-presidents; John de R. Storey, secretary and director; C. W. Welch, treasurer; C. A. Wilson, C. M. Loeb, C. E. Dodge, C. W. Nichols, R. L. Agassiz and J. H. Anderson, directors. Stockholders or members are the American Smelting & Refining Company, the Inspiration Consolidated Copper Company, the Mother Lode Coalition Mines Company, the Nevada Consolidated Copper Company, the New Cornelia Copper Company, the Utah Copper Company, the Anaconda Copper Mining Company, the American Metal Company, Ltd., the Nichols Copper Company and the United Verde Copper Company.

"The export trade act grants exemption from the anti-trust laws to an association entered into and solely engaged in export trade, with the provision that there be no restraint of trade within the United States or restraint of the export trade of any domestic competitor, and with the further prohibition of any agreement, understanding, conspiracy or act which shall enhance or depress prices or substantially lessen competition within the United States or otherwise restrain trade therein."

Value of Electrical Exports for September, 1926, Compared with Corresponding Month in 1925

(Issued by Bureau of Foreign and Domestic Commerce)

Articles	September 1925	September 1926
Generators:		
Direct-current:		
Under 500 kw.	$51,731	$98,067
500 kw. and over	36,482	46,588
Alternating current:		
Under 2,000 kva.	41,563	19,448
2,000 kva. and over	227,789	226,121
Steam turbo-generator sets	34,889	146,660
Accessories and parts for generators	54,359	64,836
Self-contained lighting outfits	90,480	79,242
Batteries:		
Flashlight batteries	78,471	208,075
Other primary batteries	93,528	164,832
Storage batteries	201,420	293,061
Transforming or converting apparatus:		
Power transformers	169,962	200,578
Other transformers	103,713	112,762
Rectifiers, double current and motor generators, dynamotors, synchronous and other converters	66,853	352,136
Transmission and distribution apparatus:		
Switchboard panels, except telephone	188,297	100,262
Switches and circuit breakers over 10 amp.	274,660	205,190
Fuses and fuse blocks	30,984	32,858
Watt-hour and other measuring meters	64,864	26,342
Volt, watt and ampere meters and other recording, indicating and testing apparatus	120,917	238,402
Lightning arresters, choke coils, reactors and other protective devices	62,011	61,111
Motors, starters and controllers:		
Motors under 1 hp	190,510	177,083
Stationary motors:		
1 to 200 hp.	194,970	310,755
Over 200 hp.	69,782	98,170
Railway motors	49,896	205,652
Electric locomotives:		
Railway	.....	349,505
Mining and industrial	56,783	98,438
Starting and controlling equipment:		
For industrial motors	109,340	128,380
For electric railway and vehicle motors	5,010	18,896
Portable electric tools	*	33,864
Accessories and parts for motors	187,420	204,339
Electric appliances:		
Electric fans	57,475	76,977
Electric lamps:		
Metal filament	65,695	154,655
Other electric lamps	12,996	22,301
Flashlights	96,197	179,715
Searchlights and projectors	65,519	53,868
Motor-driven household device	$68,101	$198,539
Domestic heating and cooking devices	92,662	151,270
Industrial electric furnaces and ovens	17,751	10,205
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	126,979	106,155
Signal and communication devices:		
Radio apparatus	785,337	†
Transmitting sets and parts	*	5,701
Receiving sets	*	351,994
Tubes	*	77,599
Receiving set components	*	227,163
Receiving set accessories	*	262,416
Telegraph apparatus	23,880	94,001
Telephone apparatus:		
Magnetic telephones	5,617	3,074
Other telephones	50,039	32,151
Telephone switchboards	51,666	19,900
Other telephone equipment	141,720	166,556
Railway signals, switches, and attachments	23,624	36,158
Bells, buzzers, annunciators and alarms	8,411	19,313
Other electric apparatus:		
Spark plugs, magnetos and other ignition apparatus	222,759	181,913
Insulating material	137,459	137,615
Metal conduit, outlet and switch boxes	63,428	83,439
Sockets, receptacles and lighting switches	136,243	156,194
Electric lighting fixtures, interior and street	116,241	159,857
Other wiring supplies and line material	81,151	81,549
Other electric apparatus, not elsewhere specified	633,425	686,543
Rubber and friction tape	*	34,723
Globes and shades for lighting fixtures	39,307	61,856
Electrical glassware except for lighting	22,776	35,185
Electrical porcelain:		
For less than 6,600 volts	66,004	79,359
For 6,600 volts and over	86,460	79,757
Carbons, carbon brushes and electrodes:		
Electrodes for electric furnaces	78,499	108,008
Other carbon products	149,215	126,734
Insulated wire and cable (iron and steel)	13,162	17,828
Copper, bare wire	117,441	265,335
Copper, insulated wire and cable	386,596	504,754
Total electrical machinery and apparatus and supplies	$6,927,419	$9,354,013

*Not separately stated prior to Jan. 1, 1926.
†Discontinued from Jan. 1, 1926.

Nearly 24,000,000 Radio Tubes Sold Last Year

According to data collected by the Department of Commerce in the biennial census of manufacturers, the value of radio apparatus manufactured during 1925 was $170,390,572, an increase of 215.5 per cent compared with $54,000,470 in 1923, the last preceding census year. The number of tube-type receiving sets manufactured increased from 190,374 in 1923 to 2,180,622 in 1925, while the number of radio tubes increased from 4,687,400 to 23,934,658. The rates of increase were 1,045.4 and 410.6 per cent respectively.

United States Exports 50 per Cent Over Pre-War List

Though the United States has become a purveyor of manufactured goods rather than a source of raw materials and agricultural products to the world trade, it has managed substantially to increase its exports, Dr. Julius Klein, chief of the Bureau of Foreign and Domestic Commerce, points out in his annual report, recently made public. Considering the fiscal year ended July, the total foreign sales of the United States were 120 per cent greater than the yearly average from 1910 to 1914. Allowing for the generally higher price levels, the exports represented a quantity 50 per cent greater than pre-war exports.

"Exports of finished and partly finished manufacture in the fiscal year 1925-26 reached the huge sum of $2,572,000,000," Dr. Klein said. "Finished manufactures show even greater growth than partly manufactured goods." High quality and low cost of production in the quantity output of American goods were the causes assigned for the showing.

"The cumulation of these forces has increased our national efficiency to a degree I hesitate to express statistically, lest we appear to exaggerate," he continued. "While we have increased our population 16 or 17 per cent in a dozen years, we have swelled productivity of the nation by something like 30 or 35 per cent. This is why we are able to sell goods of high quality, produced under the highest real wages in the world, in competition with goods produced under lower standards of living."

Business Conditions

MORE or less of a lull in business has characterized the past week. The election and arrangements for holiday selling have influenced conditions. General business conditions continue good the country over, but spotty activity may be noticed in some sections.

In the New York territory election and budget-making influences continue to cause a slump in electrical purchases, but preliminary reports are to the effect that a good volume of inquiries for purchases may come soon. In New England the textile industry continues to pick up, and there is normal business with specialty manufacturers. Holiday appliance trade is brisk and industrial buying in good volume.

In the St. Louis and Chicago territories the general business volume is normal, and a good holiday trade is expected by appliance manufacturers. On the Pacific Coast the lumber industry continues to be active and utilities continue to buy construction materials in good volume. Appliance sales are holding up well, and the jobbers report normal business.

Recent surveys show continued expectations of prosperous business conditions for this year and the early part of next year. Electrical manufacturers anticipate increased orders in nearly all lines and are preparing production plans on the basis of encouraging territorial sales reports.

Copper Neglected and Lower in Election Week Market

The Election Day holiday interfered somewhat with the total volume of metal sales in the week ended Wednesday, but on the basis of a five-day week sales were satisfactory with the important exception of copper. Further concessions in the domestic market, bringing the price delivered to Eastern consumers below 14 cents, have not stimulated much business. A fine business has been done in zinc, however, at steady prices. Lead has declined further, with the drop in London below £30, but some producers report heavy sales. Tin business has also been stimulated by lower prices, considerable short covering being reported by dealers.

NEW YORK METAL MARKET PRICES

	Oct. 27, 1926 Cents per Pound	Nov. 3, 1926 Cents per Pound
Copper electrolytic	14.00	13.95
Lead, Am. S. & R. price	8.25	8.00
Antimony	13⅜	13⅜
Nickel, ingot	35	35
Zinc spots	7.55–7.57½	7.60
Tin, Straits	69¼	69¾
Aluminum, 99 per cent.	27	27

Base copper price Nov. 3, 1926, 16¼ cents.

New England Has Steady Volume of Sales

Although no outstanding orders mark the trend in business in the New England States, the undercurrent of sales made up of small orders and renewals is steady and shows little lag. During the past week the demand for small motors was brisk; as compared with the week previous. One manufacturer reports an increase of more than $20,000, and another records a similar trend. Switch and control apparatus likewise account for a considerable portion of the volume of business, and industrial activity, now approaching a peak in production in the mill district, is being reflected favorably in the demand for general supplies. Interest in heavy equipment is reserved principally for plans for next year, and in view of substation and line expansions it presages an encouraging future for central-station supplies.

Negotiations continue in good volume; turbo-generators are outstanding sales prospects in heavy industrials, and a number of interesting projects are under way. Industrial electrical heating is active, and one manufacturer reports a number of sales for lead-pot equipment on typesetting machines recently and records several plans for the early installation of two large heating furnaces for metal-working plants. Industrial electric lighting is gaining in interest. One central station reports a manifest desire among mills and factories for improved illumination.

Jobbers, on the whole, report encouraging activity and a marked advance in stocking up of supplies for Christmas trade. Household appliance sales are growing and radio is very active.

Middle West Transactions Quiet This Week

General business in the Middle West has been comparatively quiet this week. Industrial activity continues steady and utility purchasing is quite heavy, as indicated by the commitments of one large utility company — more than $135,000 per day. October was one of the most active months of the year from the standpoint of building construction, and to all appearances this month will compare favorably with the same month last year. Railroad purchasing is steady, although a trifle light. Utility companies are busy with construction work, and every effort is being made to complete work now in progress before the cold weather sets in. There has been a good demand for poles, pole-line hardware and meters, with maintenance purchases quite heavy.

Jobbers' sales continue good. There has been a fair demand for motors and a good demand for conduit and wiring devices. Hotel and restaurant equipment is in good demand, while most appliances are moving steadily, with a particularly good market for cold-weather appliances. Vacuum cleaners are moving well, and there is an increasing demand for ironing machines.

Prices remain generally firm. Lead prices dropped a trifle, resulting in a reduction in the price of lead-covered wires and cables. While for the most part wire prices are firm, indications this week show that considerable concessions in prices are being made for quantity orders, particularly for lead-covered wires and cables.

Normal Conditions in St. Louis Territory

The manufacturers of electrical machinery and equipment report that during the past week there have been no large deals closed. The St. Louis Water Department opened bids for turbine-driven centrifugal pumping machinery, estimated to cost about $400,000, but the contract has not yet been awarded. This is the first letting for machinery to be installed in connection with the new water supply for the city coming directly from the Missouri River. One jobber reports the closing of an order for outdoor substation switching equipment amounting to $5,000. This material is to be used by one of the distributing companies operating in southeast Missouri. Jobbers, generally, report business good in all lines, even better than the previous week, especially the new models of radio apparatus and holiday goods.

Southeast Recovering from Break in Cotton

All factors considered, the month of October was a satisfactory one in electrical trade lines in the Southeast, and indications are that the worst effects of the bad break in the cotton market have been discounted and that conditions for the remainder of the fall will continue more stable than was anticipated two weeks ago. One of the largest local jobbers reports his October business as 20 per cent ahead of that for the same month last year. Confidence in underlying conditions is evidenced in the letting this week of power and construction contracts for a new cotton mill in north Georgia which will contain 50,000 spindles and 1,400 automatic looms. The building program also includes 400 houses in the mill village. Construction on this project will start immediately. Announcement was made last week of the incorporation and organization of a three-million-dollar cement company, to be located in middle Georgia. The plant when complete will have a capacity of 3,000 barrels per day.

Line-construction materials continue in strong demand, with creosoted pine poles quoted on six to eight weeks' delivery basis. Orders were placed last week by one company for 24 miles of aluminum conductor and poles, pole-line hardware and wire for a transmission line approximately 10 miles in

length. House-wiring materials show considerable activity, especially in the middle portion of the section, and orders are coming from the contracting trade generally. No large individual orders are reported recently on heavy construction materials for industrials, but there is quite a tendency to improve existing plant layouts, with a consequent good volume of small orders reported. Purchases by central-station companies of high-tension apparatus continue satisfactory, one company alone having placed last week three orders totaling $75,500 for oil-circuit-breaker equipment and orders for high-tension distribution transformers aggregating $17,000.

In the six-60-watt lamp campaigns one company reports the sale of 90,000 lamps over its system in six weeks, while another large company sold 60,000 lamps in one city during the same period. Several similar campaigns are under way over the territory. Contract was placed last week for 800 lighting units for installation in a new office building in Atlanta. Sales of radio receiving sets of the more expensive types are not up to expectations, and indications are that the total volume is off about 20 per cent from that of the same period last year.

Electrical Business Better on Pacific Coast

The past week has witnessed excellent business, some of it spectacular. The city of Los Angeles has recently enacted that the new City Hall may exceed the municipal building height limit of 150 ft., and it will be a 28-story, 450-ft. structure, the value of its electrical equipment approximating $100,000. This includes ten carloads conduit and three carloads rubber-covered wire and lead-covered cable. Power-company business included two assortments of 25,000 bolts each, one from a northern and the other from a southern company, and an inquiry for an additional carload of bolts and braces for each. Other power-company inquiries concerned two carloads of creosote oil, 1,000 guy anchors, 200,000 ft. of ⅜-in. guy strand, and 200 60-ft. poles of 10-in. size.

Inquiries from miscellaneous industrial customers covered 2,000 ft. of 500,000-circ.mil "Tirex" cable, 250 special condulets for an oil company and 400 assorted vapor-proof fixtures for a river pier and warehouse. Power apparatus and machinery orders were above the average and included such outstanding orders as one for a sectional paper-mill drive consisting of a combination of motors for various rolls worth about $30,000, a five-thousand-dollar variable-voltage automatic traction elevator equipment, eight substation transformers, each rated at 133 kva., for the Sacramento district, worth $22,000; a bank of three induction regulators and panels, 200 amp. each, for the Salinas district, value $5,000, and three transformers, each of 200 kva., to cope with the increasing load of a cement plant. Contracting business is slowly improving, though still afflicted with small orders expensive to handle. Prices are firmer and the general tone of the market is more optimistic.

Lumber Market Active in the Northwest

Business in the Puget Sound section for the past week has been quiet in the wire, range and motor market. Holiday trade is active and industrial activities continue. One Seattle firm reports the sale of a 1,250-kw. turbine to an Oregon lumber mill. Another reports the sale of three multispeed motors to a pipe manufacturing plant. The city of Seattle purchased 18 miles of No. 8 copperweld weatherproof wire at $18.65 per 100 lb. The city of Tacoma will receive bids until Nov. 15 for sixteen subway-type circuit breakers rated at 300 amp., at 7,500 volts; also for two manually operated 200-amp. breakers and in addition for 26 300-amp., 500 volt interlocking breakers and 26 300-amp., 7,500-volt interlocking breakers. The bids include also 45 oil-fuse cut-outs rated at 100 amp., 2,300 volts, and 33 oil-fuse cut-outs rated at 300 amp., 5,000 volts and 22 potheads of the outdoor type rated at 250 amp., 7,500 volts.

The Puget Sound Power & Light Company is planning an outdoor substation in Bremerton, construction to start after the first of the year. Initial announcement is made of a proposed steel mill in Seattle, the first unit to cost about $2,000,000. A cement plant near Grotto, on the Great Northern Railroad, is projected for a capacity of 600 barrels per day. Seattle has purchased about $5,000 worth of poles and expects to buy $10,000 worth of underground boxes soon. Paper and lumber plants have been active buyers of equipment, and theaters afford good business.

Spotty Business in New York Area

Sales to central-station companies in the New York district are dull, although a fair volume of inquiries for quotations on some lines is being received. The demand for generating equipment is light, and sales of pole-line hardware, poles, cross-arms, etc., have fallen off during the past few days. Switching apparatus is stronger, several inquiries for this equipment being reported and one order amounting to about $10,000 having been placed during the past week. Transformer sales to public utility companies are weak, but inquiries have been received for a considerable number of transformers for substations. Distribution transformers are in fair demand, and a number of orders, including one for 600 kva. in transformers, have been placed recently by industrial concerns. The demand for motors among the various industries continues strong, and control apparatus is improving. Jobbers report generally spotty conditions, with some improvement in the demand for appliances.

Activities of the Trade

Power Factor Improvement Corporation Incorporated in Delaware

Articles of incorporation have been filed in Delaware for a new company having the significant name of Power Factor Improvement Corporation. While no authorized information has been given out, it is surmised that this is the preliminary step toward inaugurating a vigorous forward movement in the light and power industry for power-factor correction.

New Appointments in Timken Bearing Company

Several changes in personnel are reported by the Timken Roller Bearing Company. Yale D. Hills, who has been appointed branch manager of the Seattle service and sales company, was formerly branch manager of the Portland branch. When this branch office was closed he went to the main office at Canton, Ohio, where he remained until his present appointment. R. H. Cross, who held the position of Seattle branch manager prior to Mr. Hills, has been made assistant to G. C. McMullen, district manager of sales, industrial division. Mr. Cross will continue his offices at Seattle.

E. N. Beisheim, formerly of the Bock Bearing Company, Toledo, has been appointed assistant to the general manager of the service and sales company at Canton. S. C. Partridge has been placed in charge of the Buffalo office, industrial division, of the Timken Roller Bearing Company, taking the place of Lee Warrender, who resigned to enter another field of work. Mr. Partridge has been in the engineering department of the Timken company.

Akron Engineers Visit Timken

Forty-three members of the Akron (Ohio) Section of the American Institute of Electrical Engineers visited the Timken plant at Canton recently. Several hours were devoted to an inspection trip through the various departments. These engineers were particularly interested in the Timken steel mill. In one department five Heroult electric furnaces are in constant use to produce highly refined alloy steel. Other departments of the steel mill visited included the 35-in. blooming mill and soaking pits, the 22-in. merchant mill, the 16-in., 12-in. and 10-in. rod mills, with reheating furnaces, and the piercing mill, where solid bars of steel are pierced to form seamless tubes from which the cups and cones of the Timken bearing are made. The bearing plant, where more than 160,000,000 Timken bearings have been made, was also inspected.

Copeland Reduces Prices on Refrigerators

A price reduction affecting all but one model of the electric refrigeration equipment manufactured by Copeland Products, Inc., and the introduction of a new porcelain-lined refrigerator of moderate size are announced by

W. D. McElhinny, vice-president in charge of sales. The reduction became effective Nov. 1. The largest model, with 16.69 cu.ft. of food storage capacity, is reduced from $565 to $540, the second largest (12.96 cu.ft.) from $500 to $475, the 8.92-cu.ft. model from $435 to $410 and the 7.28-cu.ft. model from $378 to $343. The price reduction on the smaller boxes (5.7-cu.ft.) amounts to $20. Model 215, in which the mechanism is mounted on top of the box, will continue to sell at its present price, $215. The new unit will sell at $275.

The price cut applies to all cooling units as well as to the box-and-unit combinations. Cooling units for boxes up to 10, 15, 20, 30, 40 and 50 cu.ft. will sell for $195, $205, $225, $235, $250 and $300 respectively.

The Arrow Electric Company, Hartford, Conn., has placed on the market a new tumbler switch known as the "Arrow-Head."

J. H. Bunnell & Company, manufacturers of telegraph, fire-alarm and other electrical equipment as well as distributors of electrical supplies, announce the removal of their factory to new and larger quarters at Pearl and Prospect Streets, Brooklyn. The main office and warehouse of the company will continue to be maintained at 32 Park Place, New York.

The Silent Hoist Company announces the removal of its works and general offices to its new building at 762 Henry Street, Brooklyn, N. Y. The company also announces a change in its name to the Silent Hoist Winch & Crane Company, which name is intended to indicate more clearly the nature of its products.

The Frank Adam Electric Company, 3650 Windsor Place, St. Louis, announces that its New York office and warehouse are now located at 182 North Eleventh Street, Brooklyn. The company states that this new location will enable it to carry a larger stock of panelboards and cabinets for immediate delivery in the New York territory.

The Westinghouse Electric & Manufacturing Company is now offering the "Sol-lux Windo-Flood," which permits the light to be directly focused on any article in a show window. The company is also offering a new inclosed lighting unit called the "Sollaire."

The Beaver Machine & Tool Company, Inc., 625 North Third Street, Newark, N. J., announces the following additions to its sales force: J. F. Hardy, 1098 East North Avenue, Atlanta; G. L. Hayes, 4422 Orleans Street, New Orleans, and E. J. Goetz, 3430 Telford Avenue, Cincinnati.

The Graybar Electric Company announces the opening of its fifty-ninth distributing house, at Dayton, Ohio. The new Dayton sales and warehouse branch will be in charge of Clem H. Dodt, sales manager, who will report to A. R. Loughborough, Graybar sales manager at Cincinnati.

The Erie Electric Equipment Company, Johnstown, Pa., manufacturer of threadless pipe fittings for switchboards, etc., through Walter J. Kress, receiver of the company, has sold its assets less cash and accounts receivable to A. Lloyd Adams of Johnstown, Pa., for the sum of $19,300, subject to a lien of Jacob F. Kress in the amount of $7,500 plus unpaid interest.

The Francis Electrical Company, Philadelphia, has leased the three-story buliding at 126 North Sixth Street for use as local headquarters.

The LeMur Lighting Manufacturing Company, 9 Walker Street, New York, has leased space in the building at 334-44 Hudson Street, comprising about 12,000 sq.ft. of floor space, and will use it for plant expansion.

The Allis-Chalmers Manufacturing Company is opening a branch office in Jackson, Mich., with L. F. Berry as resident representative. This office, which is at 512 Reynolds Building, is a branch of the company's office in Detroit, which is under the direction of F. S. Schuyler, district manager.

The Rollway Bearing Company, Inc., Syracuse, N. Y., announces the appointment of John Parker as New England representative. Mr. Parker's engineering experience includes eleven years with Brown & Sharpe and more than fifteen years with three manufacturers of heavy equipment.

The American Electrical Works, Phillipsdale, R. I., manufacturer of bare and insulated wires, has work under way on two one-story additions to its plant, to provide for increase in output.

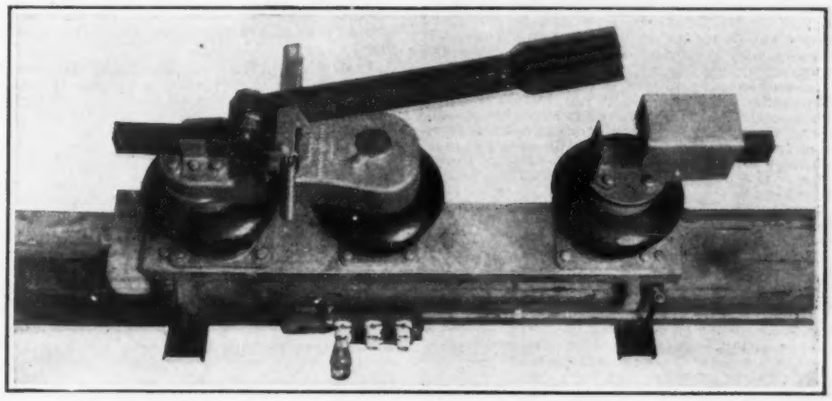
The Pennsylvania Pump & Compressor Company, Easton Pa., announces that Lee & Clark, 549 Washington Boulevard, Chicago, have been appointed its representatives in the Chicago district.

New Equipment Available

Gang-Operated Heavy-Duty Disconnecting Switch

A new gang-operated heavy-duty disconnecting switch known as the "MC-39" has been developed by the Delta-Star Electric Company, Chicago. This switch can be either motor-operated or manually operated.

The multi-part blade is of the double-action type. It is first brought to an upright position and then raised by means of levers inside the housing on top of the lower insulators. Bolted bar connections permit easy installation of heavy bus, and all rotating bearings are provided with grease cups which can be filled with an ordinary grease gun. Signal lamps, as shown in the illustration, can be installed to indicate and check the operation during installation and adjustment of the switch, thus insuring simultaneous registration by all three poles.



HEAVY-DUTY SWITCH OF THE DOUBLE-ACTION TYPE RATED AT 1,600 AMP. FOR OPERATION AT 37 KV.

Grounding Chain

The Elwel grounding chain, especially designed for grounding high-tension wires while repairs are being made, has been placed on the market by the American Chain Company, Inc., Bridgeport, Conn. The manufacturer says that this chain is compact, of light weight, easy to use, rust-resisting, low in cost, and it offers low resistance. It slides easily over the conductors, it has high current capacity and high tensile strength and will not scratch line wires. The chain is made of closely twisted solid welded links which form a flexible and continuous conductor of smooth surface. It is made of No. 10 gage material (0.135) with a heavy copper surface, has an approximate weight of 16 lb. per 100 ft., contains 21 links per foot and has an approximate tensile strength of 875 lb. The resistance of a 6-ft. piece at 60 cycles and when under a tension of 40 lb., the recommended tension at which the chain should be used, is said to be 0.1 ohm.

Stage Switchboard.—The Trumbull "Controlite," in which the operating handles of the switches and dimmers are adjacent to each other in a position most convenient for the operator, has been placed on the market by the Trumbull Electric Manufacturing Company, Plainville, Conn. The switchboard is built on the integral-unit system making it easy to change any circuit at a later date. All fuses are grouped in one place. The dimmers used are Ward Leonard's continuous-duty "Vitrohm" type. The entire unit is of the dead-front type.

New Trade Literature

POWER FACTOR.—The Electric Machinery Manufacturing Company, Minneapolis, has published a booklet called "The Power-Factor Book" which is intended to help toward a better understanding of the subject throughout the industry. The booklet, which is well illustrated and contains many graphs, has chapters devoted to the explanation of power factor, the causes of low power factor, the effects of low power factor in industry, available remedies for low power factor, synchronous motors as improvers of power factor, graphic solution of problems and rate practices with reference to power factor.

ELECTRIC FLOW METER.—A folder issued by the Brown Instrument Company, Philadelphia, describes and illustrates the new Brown electric flow meter, utilizing the inductance bridge principle.

INSULATING OIL.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, is distributing leaflet L-20291, describing the Universal Wemco C insulating oil, which can be used for all oil-insulated apparatus, including transformers, oil circuit breakers, induction feeder regulators, etc.

MOTORS.—Bulletin No. 205 issued by the Ohio Electric & Controller Company, 5900 Maurice Avenue, Cleveland, describes and illustrates the Ohio ball-and-sleeve-bearing motors, manufactured in sizes from ¼ hp. to ⅓ hp.

SWITCHES.—The Wadsworth Electric Manufacturing Company, Covington, Ky., has published catalog No. 20, covering its accessible fuse meter service and main entrance switches.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase or agency is desired in Leipzig, Germany (No. 22,705), for butchers' machines, coffee mills, jewelers' machines, devices for filling accumulators, dish washing and wiping machines, textile-cutting machines and hair-cutting machines, manicure apparatus and electrically heated blankets.

An agency is desired in Johannesburg, South Africa (No. 22,738), for electric cooking devices.

Purchase is desired in Punta Arenas, Chile (No. 22,706), of electrical goods, including motors, generators, lighting fixtures and wiring material.

Purchase is desired in Wellington, New Zealand (No. 22,707), of flashing and intermittent signs.

Purchase or agency is desired in London, England (No. 22,733), for washing machines, vacuum cleaners, refrigerators, heating and cooking devices and small electric motors.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

PORTSMOUTH, N. H.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Nov. 9, for one motor-generator set, booster, complete with switchboard, etc., for the local navy yard (Schedule 6182).

BRANDON, VT.—The Hortonia Power Company, recently acquired by interests headed by Samuel Insull, president of the Middle West Utilities Company, 72 West Adams Streets, Chicago, is reported to be planning extensions in transmission lines for connection with other properties owned by the Insull interests in the New England district.

WORCESTER, MASS. — A permit has been granted the American Steel & Wire Company to erect a substation at its South Works, to cost about $20,000.

NEW HAVEN, CONN. — Arrangements have been made between the City Council and the United Illuminating Company for the renewal of the contract for street lighting which expires the end of the year. The new contract will provide for the elimination of the 831 arc lamps now in use to be replaced with incandescent lamps of 600 cp. The installation of 336 ornamental lamps is also under consideration.

Middle Atlantic States

BROOKLYN, N. Y.—The Department of Public Welfare, Municipal Building, New York, will soon start work on an addition to its power house on Winthrop Street, to cost about $50,000. Dodge & Morrison, 160 Pearl Street, New York, are architects.

BROOKLYN, N. Y.—The American Can Company, 120 Broadway, New York, will install electric power equipment in its proposed new six-story plant on Forty-third Street near First Avenue, to cost approximately $400,000.

EDWARDS, N. Y.—Permission has been granted the Edwards Electric Light & Power Company to extend its service to adjacent territory in the town.

GLENFIELD, N. Y.—Authority has been granted the Otter Creek Power Corporation to extend its electric service in the town of Martinsburg, Turin and Watson. Approval of franchises given by the Towns Boards has also been given.

LORRAINE, N. Y.—Permission has been granted the Lorraine Electric Company, Inc., to build an electric light plant in Lorraine.

MIDDLETOWN, N. Y.—Bids will soon be asked by the State Hospital Commission, Capitol, Albany, for the installation of a refrigerating plant at the Middletown State Hospital.

NEW YORK, N. Y.—Bids will be received by Albert Goldman, Commissioner of Plant and Structures, Eighteenth Floor, Municipal Building, until Nov. 8 for furnishing and installing lead-covered cable along Tenth Avenue and Amsterdam Avenue.

PORT HENRY, N. Y.—The Adirondack Power & Light Corporation plans improvements and extensions to the local plant and to develop certain power sources in this section.

POUGHKEEPSIE, N. Y.—The Public Service Commission has granted the Central Hudson Gas & Electric Company permission to extend its electric and gas plants in Poughkeepsie.

EDGEWATER, N. J.—The Kellogg Products Company, Inc., 1317 Elk Street, Buffalo, plans to install electric power equipment at its proposed local linseed oil works, to cost about $200,000. Plumer & Mann, 700 Main Street, Buffalo, are architects.

NEWARK, N. J.—The City Commission, has authorized an additional appropriation of $215,000, for the proposed power plant for municipal service, to be erected at rear of the City Hall, making a total fund of $415,000 for the station. J. S. Pigott, 14 Park Place, is architect.

SEA ISLE CITY, N. J.—The Atlantic City Electric Company, Atlantic City, is negotiating for the purchase of the municipal electric system and plans expansion in this section, including extension of transmission lines.

KUTZTOWN, PA.—Plans are under way by the Chamber of Commerce for the installation of an ornamental lighting system on Main Street from Normal Hill to Kemps Hill, a distance of about 1½ miles.

PHILADELPHIA, PA. — The Quaker City Cold Storage Company, Water and Spruce Streets, plans to install electric power equipment in its proposed cold storage and refrigerating plant to cost $1,700,000.

HAGERSTOWN, MD.—Plans are being considered by the American Soap Corporation, 475 Fifth Avenue, New York City, for the construction of a new factory at Hagerstown. The proposed plant will cost about $750,000 and will include power house, machine shop, etc.

ST. MARY'S, W. VA.—The Monongahela West Penn Public Service Company, Fairmont, is considering the erection of a transmission line to Pennsboro and vicinity, via Ellensboro.

ALEXANDRIA, VA.—An extension of the ornamental lighting system, to cost about $20,000, is under consideration by the City Council.

DANVILLE, VA. — The Appalachian Power Company, Bluefield, W. Va., is negotiating for the purchase of the municipal electric light and power plant. If taken over the company plans extensions and improvements in this district, including extensions in transmission lines.

GROVE, VA.—Plans are under way by the Shenandoah River Power Company, Weyer's Cave, to finish the uncompleted power plant on the Shenandoah River at Grove early next year.

McCOY, VA.—The Great Valley Anthracite Corporation, Calvert Building, Baltimore, Md., contemplates the installation of electric power equipment and mining machinery at its local coal properties.

WASHINGTON, D. C. — The Commissioners of the District of Columbia have appropriated $150,000 for additional street lighting.

WASHINGTON, D. C.—Bids will be received by the Quartermaster, Marine Corps, Washington, until Nov. 9, for two 6-hp. electric motors (Schedule 235).

WASHINGTON, D. C.—Bids will be received by the Constructing Quartermaster, Washington, D. C., until Nov. 10, for electrical work in the machine shop and hangar at Bolling Field.

WASHINGTON, D.C.—Bids will be received by the General Purchasing Officer, Panama Canal, Washington, until Nov. 15, for transformers, condensers, switches, sockets, cutouts, etc. (Panama Circular 1765).

North Central States

ANN ARBOR, MICH.—The City Council is considering installing new ornamental lamps on Main Street to replace the present lighting system, and also to erect ornamental lamps on a portion of Broadway.

DEARBORN, MICH.—The installation of pumping equipment in connection with extensions to the municipal water system, to cost about $500,000, is under consideration by the City Council.

FLINT, MICH.—Plans have been filed by the Fisher Body Corporation, Detroit, for the construction of a power plant at its local factory, to cost about $120,000.

LANSING, MICH.—The Hunt Show Case Company contemplates the installation of electric power equipment in its proposed plant addition, cost about $200,000.

PONTIAC, MICH. — The Grand Trunk Railway System, plans to build a power plant at its proposed local terminal yard and shop division for which an appropriation of $1,500,000, has been approved.

YPSILANTI, MICH.—Plans has been approved by the Ford Motor Company, Detroit, for a proposed hydro-electric generating plant on the Huron River, near here, to cost about $1,000,000. A stand-by steam-operated power plant will also be built in this section for emergency service. Stone & Webster, Inc., 147 Milk Street, Boston, is engineer and contractor.

CINCINNATI, OHIO.—The installation of ornamental lamps on Warsaw Avenue in ths suburb of Price Hill has been approved by the City Council.

CINCINNATI, OHIO—Plans have been filed by the Union Gas & Electric Company for the construction of a substation on Minnesota Avenue, near Reading Road, to cost about $19,000.

GALLIPOLIS, OHIO.—The City Council is considering calling an election to vote on the proposal to issue $105,000 in bonds for a municipal electric light plant.

MAUMEE, OHIO.—The installation of an ornamental lighting system on Conant Street is under consideration.

CARROLLTON, KY.—Plans are under way by the Kentucky Power Company, Augusta, for doubling the generating capacity of its local plant for the purpose of supplying electrical service to five or six towns in this community.

LEXINGTON, KY.—The Dunn Wheat Company, 3 York Street, plans to install electric power equipment in its proposed new milling plant, to cost about $300,000.

PADUCAH, KY.—Arrangements are being made by the Illinois Central Railroad Company, Chicago, for the construction of a power plant at its local shops, to cost about $100,000.

PAINTSVILLE, KY.—The construction of a new ice plant, to cost about $50,000, is contemplated by the Artic Ice Company.

SOMERSET, KY.—Extensions are contemplated by the Kentucky Utilities Company, Louisville, to its local power plant and transmission lines.

APPLETON, WIS.—The installation of a new electrically-operated traffic signal system is under consideration by the City Council.

DUNKIRK, WIS.—Plans have been authorized by the Town Council for the installation of a municipal electric light plant. The Power Engineering Company, Metropolitan Life Building, Minneapolis, is engineer.

HARTFORD, WIS.—To meet the increasing demands for electrical service the City Council is considering the installation of a 750-kw. generating unit in the municipal electric plant, to cost about $75,000, or to purchase surplus energy from a private company.

MILWAUKEE, WIS.—Steps have been taken by the Grand Avenue Business Men's Association for the installation of an ornamental lighting system on Grand Avenue from the bridge to the Court of Honor.

SHAWANO, WIS.—A contract has been awarded by the Wisconsin Power & Light Company, Madison, to the L. E. Myers Company, Chicago, for the construction of a hydro-electric plant on the Wolf River, to cost about $250,000.

WAUPUN, WIS. — Arrangements have been made between the City Council and the Wisconsin Power & Light Company whereby the latter will build a high-tension transmission line from Beaver Dam to Waupun, at a cost of about $30,000.

WEST BEND, WIS.—The West Bend Aluminum Company plans to build a substation, to cost about $17,000.

MINNEAPOLIS, MINN.—Electric power equipment will be installed in the proposed addition at the plant of the Minneapolis Heat Regulator Company, Fourth Avenue South, to cost $200,000.

TWO HARBORS, MINN.—Bids, it is understood, are being received by Ernest Carlson, city clerk, for a 500-kw. electric generating unit, and one 275 to 300-hp. boiler or two 150-hp. boilers.

ARMSTRONG, IOWA—Plans are under way by the Iowa Railway & Light Company, Cedar Rapids, for the construction of an addition to its local power plant, to cost about $22,000. The company also plans to enlarge its power plant at Correctionville, at a cost of about $22,000.

DENISON, IOWA—Plans have been approved by the City Council for extensions and improvements in the municipal electric power plant, to cost about $30,000.

POCAHONTAS, IOWA—Negotiations are under way between the City Council and the Central States Electric Company, Cedar Rapids, for the purchase of the municipal electric plant by the latter. If taken over the company plans to install a Diesel engine driven electric generating plant, rebuild the distribution system, etc.

ST. LOUIS, MO.—Plans for the proposed new plant of the Moloney Electric Company, 1149 South Seventh Street, to be erected at Union Street and the Kingshighway, to cost about $1,000,000, include a power plant.

SPRINGFIELD, MO.—Plans are under way by the Springfield Ice & Refrigerating Company to build a cold storage and refrigerating plant, to cost about $50,000. Ophuls & Hill, 112 West Forty-second Street, New York, are engineers.

BRINSMADE, N. D.—The City Council has approved the erection of a transmission line to connect with the system of the Otter Tail Power Company, Fergus Falls, Minn., for local service. V. H. Sprague is city engineer.

ELLENDALE, N. D.—The plant of the Ellendale Electric Company has been acquired by the Northern Power & Light Company, which plans to erect a high-tension transmission line between Ellendale and Lehr. D. L. Oslund is chief engineer.

FORDVILLE, N. D. — The Otter Tail Power Company, Fergus Falls, Minn., plans to erect a transmission line from Forest River to Fordville, for local light and power service.

SALEM, S. D.—The Salem Milling, Lighting & Heating Company plans to build a new power house and to erect a transmission line extending to Canova to connect with the line of the Dakota Public Service Company.

PLATTSMOUTH, NEB.—Plans are being prepared by the United Light & Railways Company, 733 Illinois Merchants Bank Building, Chicago, for the construction of a 66,000-volt substation at Plattsmouth. Provision will be made to control four 66,000-volt lines as well as the feeder circuit feeding the city of Plattsmouth. Two of the lines are already in operation, one leading to Lincoln and the other to Malcern, Iowa a third line is now under construction from Omaha to Plattsmouth, which will connect the proposed substation with the large power station of the Nebraska Power Company at Omaha.

Southern States

BOWDON, GA.—The Georgia Utilities Company, a subsidiary of the Georgia Railway & Power Company, has purchased the municipal electric distribution system and will extend its transmission lines here.

EATONTOWN, GA.—The Georgia Southern Power Company, Dublin, has purchased the local electric distribution system and will take over same on Dec. 1. A 44,000-volt transmission line, about 20 miles long, will be erected to tie in the system with the transmission system of the company. Pending the erection of this line the town will be supplied from the present plant.

JACKSONVILLE, FLA.—At an election held Oct. 26 the proposal to issue $2,000,000 for extensions to the municipal electric system was carried. The money will be appropriated as follows: Changes and extensions to the Main Street substation and machinery for same, $473,500; three 1,500-hp. boilers, superheaters, etc., $405,500; one 25,000-kw. turbo-generator with condensing equipment and switchboards, $746,000; miscellaneous heaters, boilers, feed pumps, valves, etc., $45,000; changes in present crane and 12,500-kw. turbo-generator to adapt same to new requirements, $80,000; changes and additions to underground district, including high-voltage cables, substations and switchboard equipment to carry the additional load, $400,000.

MIAMI SHORES, FLA.—The town officials are considering calling an election soon to vote on the proposal to issue $35,000 in bonds for street lamps and equipment.

CROSSVILLE, TENN.—Preparations are being made by the Tennessee Electric River Power Company, Chattanooga, to enlarge its local power plant and to extend its transmission line to Crab Orchard to supply electricity to the Southern States Lime Corporation.

ERWIN, TENN.—Bids are being taken for the installation of an ornamental lighting system in the business section.

FOLEY, ALA. — The Foley Light & Power Company, plans extensions in transmission lines to serve electricity to a number of adjacent districts.

GORDON, ALA.—Negotiations are under way by the Alabama Power Company, Birmingham, for the purchase of the local electric plant. If acquired the company plans extensions in its transmission lines in this section.

GULFPORT, MISS. — The Mississippi Power Company, Gulfport, has acquired the electric distributing systems in Columbus, Muldon, Strong, Shannon, Verona, Saltillo, Guntown, Baldwyn, Wheelers and Booneville, from the Mississippi Power & Light Company. The steam plants at Tupelo and Columbus, the 90-mile transmission line which connects all the towns, etc., were included in the purchase. The company contemplates rehabilitating all of the properties, and also plans to build a high-voltage substation at West Point and connect with its existing high-tension transmission system.

HICKORY, MISS.—The City-State Investment Company, New Orleans, is building a power plant in Hickory. The company has a franchise to supply service in Decatur, Chunky and Hickory.

UNION, MISS. — The Inland Utilities Company, which recently purchased the municipal electric plant, is planning extensions in transmission lines in this section.

CEDAR GROVE, LA.—Plans are beng prepared by the Independent Ice & Refrigerator Company, Abilene, Tex., for an ice plant, to cost about $50,000.

LAWTON, OKLA. — The Southwestern Light & Power Company, Oklahoma City, plans to install electric power equipment in its proposed local ice-manufacturing plant, to cost about $150,000.

ALPINE, TEX.—Steps have been taken by the Chamber of Commerce for extension of the street-lighting system.

AUSTIN, TEX.—Bids will be received by the Board of Trustees of the University of Texas, until Nov. 18, for the construction of a power plant at the institution, to cost about $350,000.

BROWNSVILLE, TEX.—Bonds to the amount of $40,000 have been voted for improvements to the municipal electric plant.

DALLAS, TEX.—Plans have been filed by the Dallas Power & Light Company for the erection of a substation at 515 Park Avenue, to cost about $50,000.

LEVELLAND, TEX.—The Texas Utilities Company, Plainview, is considering extensions in its local electric generating plant.

MIDLAND, TEX.—The City Council is considering calling an election to vote on the proposal to issue $30,000 in bonds, of which $5,000 will be used for an ornamental lighting system.

Pacific and Mountain States

SEATTLE, WASH.—Plans are under consideration by the Municipal Lighting Department of Seattle and Tacoma, relative to a proposed ornamental lighting system on the High Line Road between the two cities, to cost about $100,000.

BEVERLY HILLS, CAL.—Bids will be received by the City Trustees until Nov. 15 for cast iron standards, conduits, etc., for ornamental street lighting system on Wilshire Boulevard, to cost about $25,000.

FRESNO, CAL.—The City Council has adopted a resolution providing for the installation of ornamental lamps on portions of H, Stanislaus, Calaveras and San Joaquin Streets, requiring about 75 standards, of combination steel and cast iron type.

LONG BEACH, CAL.—Bids are being received by the City Council for ornamental lighting system on Seventh Street, between Redondo Boulevard and Alamitos Street, to cost about $40,000.

LONG BEACH, CAL.—The Long Beach Terminal Warehouse Company plans to install electric power equipment in its proposed cold storage and refrigerating plant on the West Channel, to cost about $500,000. Edgar Cline, Petroleum Security Building, Los Angeles, is architect.

LOS ANGELES, CAL.—Bids will be received by the Water and Power Commission, 207 South Broadway, until Nov. 12, for a power plant and auxiliary (Specification P-389). James P. Vroman is secretary.

LOS ANGELES, CAL.—Bids will be received by the Board of County Freeholders, Hall of Records, until Nov. 15, for the installation of additional ornamental lighting units in the Graham Lighting District, and the Miramonte-Florence Lighting District.

OAKLAND, CAL.—Plans are under way for the installation of 350 lamp standards on portions of Broadway, Washington Street and other thoroughfares. The cost is estimated at $200,000.

SAN BERNARDINO, CAL.—The California Ice Company plans to install electric power equipment in its proposed ice-manufacturing plant at Third and I Streets, to cost about $200,000.

TURLOCK, CAL.—The Turlock Irrigation District is considering a new bond issue of $600,000, the fund to be used for the installation of two additional power units at the Don Pedro hydro-electric station.

VISALIA, CAL.—Bids will be received by G. Stewart, Clerk of Tulare County, until Nov. 23 for construction of hospital building and power house, including refrigerating plant and elevators, to cost about $150,000. Kump & Johnson, Rowell Building, Fresno, are architects.

MARYSVILLE, MONT.—Surveys have been authorized by the Montana Power Company, Butte, for the erection of a proposed transmission line for power service in the Marysville and Gould mining districts.

Canada

GANANOQUE, ONT.—The Skinner Company, Ltd., Gananoque, is reported to be planning the installation of electric power equipment in its proposed new two-story plant for the manufacture of automobile bumpers, etc., reported to cost in excess of $50,000 with machinery.

HAMILTON, ONT.—The Dominion Power & Transmission Company plans to build new car barns and repair shop, to cost about $200,000.

LONDON, ONT.—Plans are being prepared by the Utilities Commission for removing overhead wires and laying cable underground for high-tension Hydro wires underground, at a cost of about $50,000. E. V. Buchanan is engineer.

MONTREAL, QUE.—Permission has been granted the Canadian Light & Power Company to erect an electric transmission line connecting the parishes of St. Clement de Beauharnois, Ste. Martine, Ste. Philomene, St. Isidore, St. Constant, De Lery and St. Joachim.

Electrical Patents

Announced by U. S. Patent Office

(Issued Oct. 12, 1926)

1,602,523. ROTOR FOR ELECTRIC MACHINES; C. W. Dake, Chicago, Ill. App. filed Nov. 14, 1925. Means for fastening or holding the rotor in position on the rotating shaft, whereby the rotor may be properly positioned without warping or straining of any of the parts.

1,602,525. METHOD OF MANUFACTURING METALLIC FILAMENTARY MATERIAL; W. B. Gero, East Orange, N. J. App. filed Jan. 13, 1921.

1,602,526. CONTROL OF CRYSTAL DEVELOPMENT IN REFRACTORY METALS; W. B. Gero, East Orange, N. J. App. filed Sept. 15, 1922. The manufacture of refractory metals suitable for incandescent electric lamp filaments; the control of the crystalline development of tungsten by the addition of selected materials.

1,602,559. DEVICE FOR CONTROLLING THE TEMPERATURE OF STORAGE BATTERIES; W. A. Strawmyer, Omaha, Neb. App. filed April 18, 1922. An improved form of thermostat and an improved housing and connecting means for the thermostat.

1,602,584. INSULATOR CLAMP; J. S. Lawson, St. James, N. Y. App. filed Nov. 5, 1923. In which the elements engaging the line wire are in a measure free to accommodate themselves to changes in its position relatively to the insulator.

1,602,586. ELECTRIC FLASHING DEVICE; J. W. Phelps, Chicago, Ill. App. filed May 24, 1924. Automatic electric flasher or cut-out adapted to be interposed in circuit between a lamp and its socket.

1,602,616. ELECTRICITY METER; S. James, Birmingham, England. App. filed Aug. 27, 1923. In which a maximum demand and a specified power factor is made the basis of contract.

1,602,634. MANUFACTURE OF EVACUATED VESSELS; W. E. Anderson, Great Notch, N. J. App. filed May 27, 1922. The production of the proper degrees of vacuum in incandescent lamps.

1,602,682. APPARATUS FOR WELDING AND ANNEALING METAL PARTS; F. S. Kochendorfer, River Forest, Ill. App. filed Aug. 31, 1922.

1,602,718. ELECTRIC CONTROL DEVICE; W. C. Stevens, Milwaukee, Wis. App. filed Feb. 11, 1926. Applicable to operating mechanisms for compensator starters.

1,602,743. ELECTRIC MOTOR PROTECTION; S. C. Benson, Harrisville, Ohio. App. filed Oct. 25, 1921. Whereby the course of electric supply for the motor may be cut off automatically and the motor stopped, first, in the event of lack of oil in the motor journals or bearings; second, when an armature coil opens and causes sparking at the brushes; third, upon the fields becoming grounded, and, fourth, if an open field circuit occurs.

1,602,770. PRESSURE SIGNAL; J. Kantor, Chicago, Ill. App. filed Nov. 19, 1923. For use in connection with apparatus for charging water intended for beverages with carbonic acid gas.

1,602,787. ELECTRIC GENERATOR SYSTEM; R. H. Sullivan, Rochester, N. Y. App. filed Oct. 27, 1925. In which a storage battery is charged by an electric generator, with an electromagnetic cut-out interposed between the battery and the generator to prevent return flow of current from the former to the latter, and in which an electromagnetic regulator is used to control the output of the generator with respect to some function of the voltage across the generator terminals.

1,602,804. ELECTRIC HEATING DEVICE; L. H. Wilkinson and A. M. Young, Meriden, Conn. App. filed Jan. 7, 1926. Electric toaster.

1,602,850. CARBON FOR DEPOLARIZING COMPOSITIONS AND PROCESS OF CONDITIONING THE SAME; G. W. Heise, Bayside, N. Y. App. filed Dec. 19, 1922.

1,602,859. HIGH-FREQUENCY DEVICE FOR ELECTROMEDICAL OBJECTS; K. O. Sikor, Vienna, Austria. App. filed July 15, 1925.

1,602,871. SNAP SWITCH; C. Aalborg, Pittsburgh, Pa. App. filed Oct. 9, 1920. Toggle type.

1,602,872. MEASURING DEVICE; C. T. Allcutt, Pittsburgh, Pa. App. filed Feb. 3, 1923. A measuring instrument having a normally freely movable element and automatically actuated braking or holding means for retaining the indicating member in its position of last indication, or, as in a flashover test for an insulator, the position indicating the voltage value at which the insulator flashed. The holding means is also adapted to automatically release the meter element when energized for a subsequent test, so that the operator is free to direct his attention to the object to be tested rather than to the testing instrument.

1,602,873. SUPPORT FOR ELECTRICAL FIXTURE; H. K. Ansingh, Murrysville, Pa. App. filed July 13, 1922. Supports for attaching electrical fixtures, such as busbars, switch jaws, fuse blocks, etc., to pin-type insulators.

1,602,876. THERMAL RELAY; W. M. Bradshaw, Wilkinsburg, Pa. App. filed Sept. 23, 1921. Of the cartridge type.

1,602,882. MEASURING INSTRUMENT; L. W. Chubb, Edgewood, Pa. App. filed Sept. 23, 1922. Method of and means for measuring or utilizing a differential effect between alternating-current circuits fed from different sources.

1,602,909. ANODE FOR MERCURY-VAPOR RECTIFIERS; J. Kübler, Baden, Switzerland. App. filed June 6, 1921.

1,602,910. METAL VAPOR RECTIFIER; J. Kübler, Baden, Switzerland. App. filed May 31, 1922.

1,602,911. REGULATOR; E. E. Lehr, Wilkinsburg, Pa. App. filed April 13, 1922. Induction regulators; an improved form of regulator with an intermediate bearing provided near the upper end of the stator winding.

1,602,915. DRY CELL; G. M. Little, Pittsburgh, Pa., and J. G. Ford, Wilkinsburg, Pa. App. filed Sept. 27, 1922. Consisting of a glass container, generally about 2 in. high and ¾ in. in diameter, in the bottom of which is placed a heavily amalgamated zinc plate to which a lead wire is secured by any suitable means. A starch paste containing the electrolyte is placed on the zinc plate and a depolarizing paste is placed thereupon. A carbon-rod anode projects into the depolarizer, and the cell is sealed with suitable wax.

1,602,918. INSULATOR; W. J. Martinez, Berkeley, Cal. App. filed March 11, 1922. Cleat type; cylindrical.

1,602,920. ELECTRIC SWITCH; W. E. Menzies, Wilkinsburg, Pa. App. filed Feb. 19, 1921. Quick-make-and-break type.

1,602,934. ALTERNATING-CURRENT RECTIFIER; C. J. Quill, San Francisco, Cal. App. filed May 2, 1922. A mechanical rectifier for the production of unidirectional current from alternating current, a synchronous motor being used to operate the rectifying apparatus.

1,602,942. AUTOMATIC CONVERTER STATION; T. W. Ross, Manchester, and C. Ryder, Failsworth, England. App. filed June 28, 1923. Means for automatically starting and synchronizing the motor converter at a substation and also to provide improved safety devices in connection therewith.

1,602,946. PANTOGRAPH TROLLEY; C. H. Schafer, Sharpsburg, Pa. App. filed Jan. 25, 1924. Pantograph structures and actuating mechanism to facilitate raising and lowering the collector shoes thereof, relative to overhead supply line.

1,602,947. FRAME FOR DYNAMO-ELECTRIC MACHINES; G. Schroeder, Hale, Eng. App. filed Jan. 26, 1917. Supporting or inclosing frames for the stationary magnetizable core members of machines of large capacity, such as turbo-generators.

1,602,951. ELECTROLYTE FOR ELECTROLYTIC CELLS; J. Slepian, Wilkinsburg, and E. J. Haverstick, Oakmont, Pa. App. filed Dec. 9, 1919. Such as lightning arresters, condensers, rectifiers and the like. An electrolyte which shall be capable of acting upon film-forming metals, such as aluminum, magnesium, titanium and the like, to produce plates of high electric capacity and to provide the plates with asymmetric conducting films of great endurance when subjected to potentials of considerable magnitude for long periods of time.

1,602,952. THERMAL RELAY; B. H. Smith, Wilkinsburg, Pa. App. filed June 9, 1920. Of the cartridge type.

1,602,965. CONDUCTOR SUPPORT; H. P. Chandler, Mansfield, Ohio. App. filed Aug. 19, 1924. The connecting or supporting of the ends of two trolley wires in adjacent relation so as to constitute as nearly as possible a continuous conductor.

1,602,976. LIMIT SWITCH; C. M. Hodgkins, Pittsburgh, and F. M. Parks, Murrysville, Pa. App. filed June 25, 1920. Such as are employed in combination with controllers for motors used in operating crane machinery.

1,602,993. CONTROL AND PROTECTION OF ELECTRICAL APPARATUS; H. Tinsley, Wakefield, and J. H. Cox, Outwood, near Wakefield, Eng. App. filed April 1, 1926. Combined remote or distant control and the protection by earthing of electrical apparatus, and more particularly portable apparatus such as electrically driven coal-cutting machines and conveyors used in mines.

1,603,007. CONTROL APPARATUS; A. L. Harvey and O. C. Cordes, Wilkinsburg, Pa. App. filed April 16, 1923. Limit switches for the control of machine tools and similar machines.

1,603,035. CONNECTOR HOOK; L. W. Evans, Pittsfield, Mass. App. filed Sept. 16, 1924. Tap-off or connector hook whereby a branch circuit conductor may be safely connected to and disconnected from a power circuit while the latter is under full potential.

1,603,039. ELECTRICAL CONDUIT FITTING; O. A. Frederickson, Wethersfield, Conn. App. filed May 31, 1923. Construction for the elbow caps of metal molding whereby the elbow caps are readily adaptable to running caps of different depths.

1,603,049. AUTOMATIC CONTROLLER; C. I. Hall, Fort Wayne, Ind. App. filed Jan. 4, 1922. A controlling device which may be set to operate after an interval, together with means for modifying the interval according to a variable of an electric current; an automatic device for opening an electric circuit, which device may be set to operate at time intervals which are inversely proportional to the square of the voltage of the circuit; a device for timing the duration of an X-ray exposure in X-ray apparatus.

1,603,050. DEMAND METER; C. I. Hall, Fort Wayne, Ind. App. filed Nov. 28, 1923. An electromagnetic ratcheting relay for demand meters and other electromagnetic counting devices.

1,603,058. TRANSFORMER; J. Biermanns, Karlshorst, Germany. App. filed March 23, 1926. Insulation for the high-voltage winding of a transformer to reduce or avoid the danger of breakdown of the insulation by providing suitable electrically conductive layers or coverings to reduce the electric stress along the junctures of the cylinders and their flanges.

1,603,060. ELECTRORESPONSIVE DEVICE; H. W. Brown, Schenectady, N. Y. App. filed March 25, 1926. A sensitive electroresponsive device which will operate in accordance with the relative values of a plurality of electric quantities, such as the potentials across a source and across the load supplied thereby, and also on the occurrence of abnormal circuit conditions such as over-current or undercurrent, overvoltage or undervoltage, reversal of current or voltage, or combinations of these conditions.

1,603,064. METHOD OF MANUFACTURING BATTERY PLATES; C. C. Carpenter, Niagara Falls, N. Y. App. filed Jan. 19, 1921. A method of pasting battery plates of the Faure type having the advantage that plates pasted by said method may be safely stacked one upon another when damp.

1,603,067. POWER-FACTOR-REGULATING SYSTEM; F. T. Coldwell, Alplaus, N. Y., and L. W. Thompson, Schenectady, N. Y. App. filed Aug. 18, 1924. System for regulating the power factor of electric power transmission and distribution circuits. The provision of an improved regulating apparatus and regulating system through which the power factor or other electrical conditions of such circuits may be readily predetermined and accurately maintained.

1,603,078. ELECTRIC SWITCH; J. D. Hilliard, Schenectady, N. Y. App. filed April 28, 1926. High-potential electric switch of the explosion-chamber fluid-break type. A switch of this type having means for relieving the explosion chamber thereof of excessive pressure, thereby increasing the capacity of the switch.

1,603,087. ELECTRIC DISCHARGE DEVICE; G. M. J. Mackay, Schenectady, N. Y. App. filed Oct. 1, 1920. A lamp provided with a conductor operating at incandescence and so arrranged that an electric discharge passes between sections of the electric conductor.

1,603,093. ELECTRIC SWITCH MECHANISM; W. J. Noonan, Mansfield, Mass. App. filed May 31, 1924. A switch lever which can be set so as to close or open as the case may be the two different electrical circuits simultaneously and to provide independent tension for each contact member of the switch, each of which may be given the tension desired.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Where the Motor Horsepower Is Installed

MODERN manufacturing consists of the transformation of materials from the raw state to the finished product by the application of energy guided by human intelligence. Wherever the process is simply repetitive, however complicated it may be, automatic machinery can be devised to perform it. If the energy involved is great, power-driven equipment will usually do the work more cheaply and more quickly than any other method. In either case the human function becomes one of supervision or control.

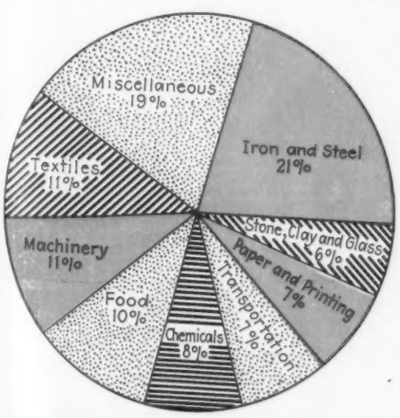
With industry so highly electrified as is now the case, a ready measure of the industrial activity of a state or region is to be found in the energy used or the motor horsepower installed. Either of these will serve as a basis for various kinds of sales quotas, consumption estimates and other forms of commercial analysis.

Study of the data for horsepower of electric motors used in manufacturing establishments, including those operated from private generating plants as well as those on central-station circuits, shows that Pennsylvania leads, with 15.1 per cent of the national total. The reason is, of course, the tremendous power requirements of the iron and steel industry. Ohio comes second, again on account of iron and steel, while New York is third, not because of any one leading industry but because of its general importance as a manufacturing state. The same holds for Illinois, with the added influence of considerable iron and steel manufacture, while textiles put Massachusetts fifth, and transportation equipment—which here means automobiles—makes Michigan sixth.

Coming to the study of the country by divisions, it is seen that the greatest agricultural section comprising the North Central States leads in motor horsepower and accounts for 37 per cent of the total for the United States. Then come the Middle Atlantic States and, third, New England.

While the divisions into which it has become customary to divide the country do in each group combine states of essentially similar characteristics, they differ enormously in area. This difference could be taken into account by working out a ratio showing the density of electrical development, so as to bring in the effect of the concentration of big industrial centers, as well as their size. If that were done, the sequence would be changed, the lead going, as might be expected, to the crowded Eastern States, headed by the Middle Atlantic, with 64.5 hp. per square mile, and New England, with 40.3 hp. The North Central division would then come third, with 10.4 hp., followed by the South Atlantic, 7.0 hp.; Pacific, 4.05 hp.; South Central, 1.94 hp., and Mountain, 0.6 hp.

Apportioned according to industries, the iron and steel group leads, with more than a fifth of the entire rating, while textile, food products and machinery are nearly equal, each taking about 10 per cent of the total. The chart is based on figures published in ELECTRICAL WORLD for Jan. 2, 1926.



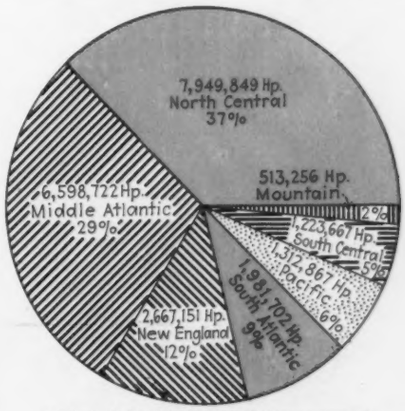
Distribution by Industries

The Iron and Steel Industry Has a Fifth of the Total

Rank of the States in Industrial Motor Horsepower

1	Pennsylvania	15.1%	3,457,471 Hp.
2	Ohio	10.3	2,291,179
3	New York	9.9	2,268,621
4	Illinois	7.2	1,567,586
5	Massachusetts	6.5	1,346,591
6	Michigan	5.2	1,160,250
7	Indiana	4.8	1,098,953
8	New Jersey	4.2	932,630
9	California	3.6	813,015
10	Wisconsin	2.7	621,054
11	Connecticut	2.4	532,007
12	Maryland	2.35	523,658
13	Missouri	1.95	433,357
14	North Carolina	1.73	383,854
15	Washington	1.40	320,412
16	Texas	1.38	308,977
17	Alabama	1.35	301,411
18	Minnesota	1.25	277,723
19	Rhode Island	1.2	268,634
20	West Virginia	1.08	241,715
21	Virginia	1.07	238,140
22	Georgia	1.05	232,440
23	Maine	1.03	229,572
24	South Carolina	1.01	225,512
25	Iowa	0.98	219,526
26	New Hampshire	0.87	197,394
27	Tennessee	0.86	193,053
28	Oregon	0.80	179,440
29	Montana	0.725	161,213
30	Kansas	0.72	159,525
31	Kentucky	0.71	158,606
32	Utah	0.50	110,518
33	Louisiana	0.47	108,528
34	Vermont	0.425	92,953
35	Colorado	0.42	92,777
36	Nebraska	0.37	84,679
37	Oklahoma	0.345	76,256
38	Delaware	0.337	74,860
39	Arizona	0.335	74,642
40	Arkansas	0.178	39,772
41	Florida	0.176	39,425
42	Mississippi	0.16	37,064
43	Idaho	0.15	34,340
44	District of Columbia	0.099	22,098
45	Nevada	0.09	20,329
46	Wyoming	0.058	13,026
47	South Dakota	0.043	9,606
48	New Mexico	0.029	6,411
48	North Dakota	0.029%	6,411 Hp.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.



Total U.S., 22,247,214 Horsepower

Distribution of Horsepower in Industries by Divisions

The North Central States Lead in Installed Horsepower

High Industrial Activity in Western States Continues

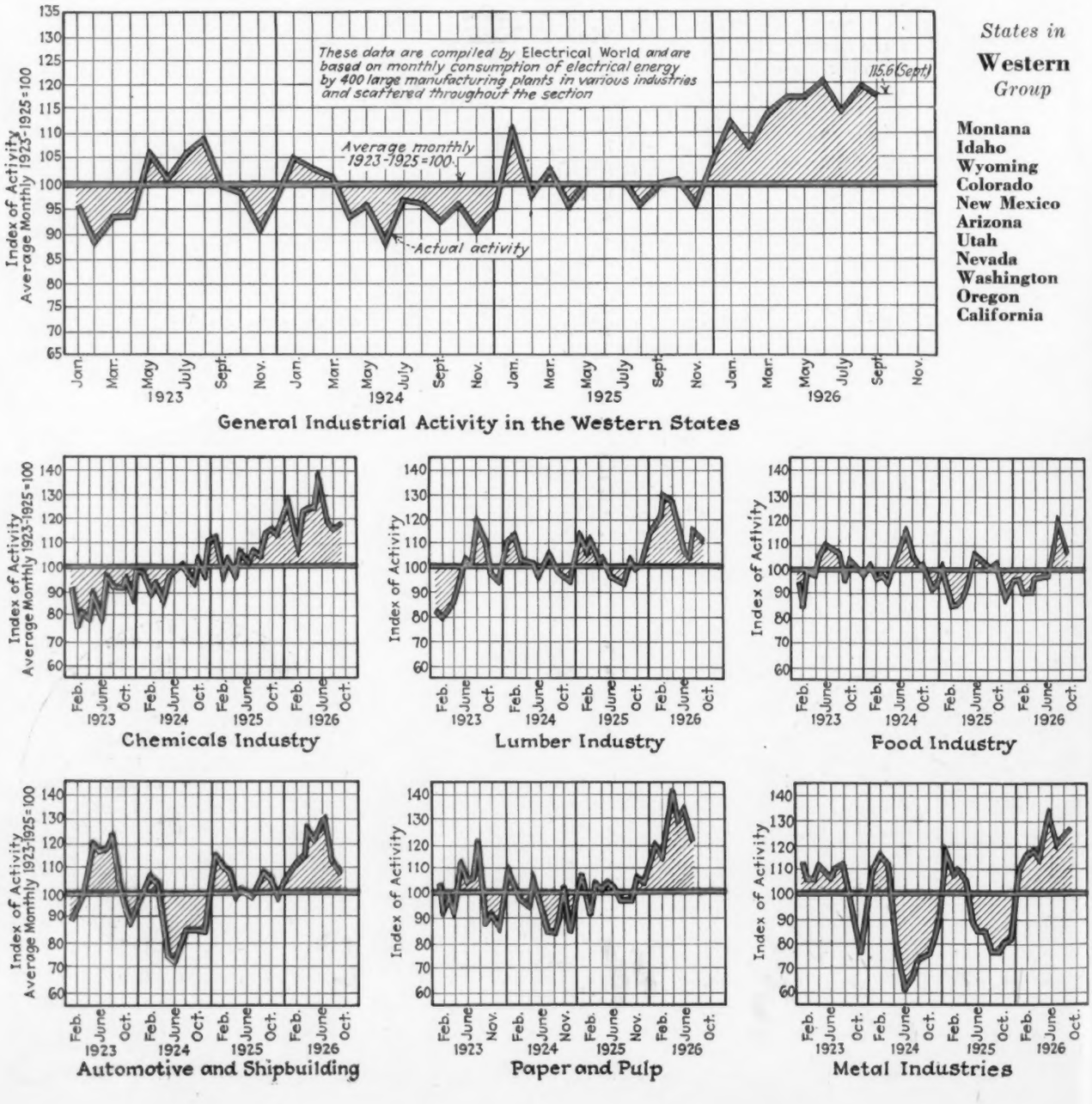
THE manufacturing plants of the Western States continue to report a high rate of operations. September activity in the general industrial life of the section was slightly below that of August, although two of the primary industries—chemicals and metals—recorded operations above those reported for the preceding month. September activity, however, was still 15 per cent above that reported in September of last year, and 15.6 per cent above the average monthly activity for the past three years. These figures are unadjusted for seasonal variation, but are weighted in accordance with the importance of the various industries.

The industries of the West appear to have been operating slightly above the operations of industry in the country as a whole since the opening of the year and do not appear to have felt the summer decrease in operations which affected industry in the country as a whole. Such is the status of industrial activity in the Western States as indicated by reports received by the ELECTRICAL WORLD based upon the monthly electrical energy consumption of about 400 large manufacturing plants in various industries and scattered throughout the section.

The food and kindred products industry, the chief industrial group of the Western States, reported September operations considerably under those of August. The food industry of the section appears to have reached its peak of operations in August, which is the top of the canning season, and it is probable that the operations in this industry will gradually decrease during the remaining months of the year. The September operations were about 9.6 per cent under those of August, but were 8.0 per cent over those for September last year.

A slight decrease in activities was reported by the lumber industry during September, but operations of the lumber mills of the section were still 5.7 per cent over those of September last year, though 14.2 per cent under the peak operations in March of this year.

Shipbuilding witnessed its greatest activity during July, September activities being about 17.8 per cent under those of the peak month. Operations in this industry, however, were still some 7 per cent above the average monthly activities during the past three years.

"Electrical World" Barometer of Industrial Activity in the Western States

(Data Unadjusted for Seasonal Variation)